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THE PROBABLE RELATIONSHIP OF PHASEOLUS POLYSTACHIOS TO OTHER SPECIES

H. A. ALLARD

THE only wild native bean in the eastern United States is the so-called Kidney Bean, *Phaseolus polystachios* (L.) BSP. This bean inhabits the Coastal Plain and the Piedmont areas, but is not found in high-mountain areas. It is a rather rare species of rich deciduous woods, where its perennial root can find winter protection under thick blankets of ground-debris and decaying leafage.

While the name "Kidney Bean" would suggest that it belongs to the species-assemblage represented by *P. vulgaris* L., there is reason to believe that its affinities may be nearer the assemblage of the Scarlet Runner beans represented by the species *P. coccineus* L. This conclusion is based upon the following behaviors.

The cotyledons of the *P. coccineus* assemblage and also of *P. polystachios* are hypogean, remaining buried in the soil, as in the case of *Pisum*. So far as known no members of the species *P. vulgaris* have this habit, the cotyledons always being carried above the soil at germination.

With respect to their length-of-day responses the varieties of *P. coccineus* tested by the writer and by other workers, have shown strong tendencies to flower most freely when experiencing long days. These varieties have either failed to flower or flowering has been greatly reduced when given daily photoperiods of 10 hours. If flowers developed, these were usually sterile or fruited very late in the season.

It may be stated that the Wild Bean, *P. polystachios*, becomes a dwarf, bushy, completely flowerless plant when given 10 hours of light. The writer's studies¹ have shown that it is an *intermediate* plant in its length-of-day behavior since flowering occurs only within a definite range of lengths of day. At certain lower limits flowering ceases because the days are too short, and at certain upper limits flowering ceases or is less profuse because the days are too long. *P. polystachios* is definitely not a short-day type and flowering is favored by long days which do not exceed certain limits. There are, on the other hand, few if any of the varieties of the *P. vulgaris* assemblage which show long-day tendencies or find lengths of day of 10 or 12 hours unfavorable to flowering.

In response to short photoperiods the roots of varieties of *P. coccineus* have usually shown strong tuberization and *P. polystachios* has shown similar tendencies, both in the field and when long-day conditions favorable to flowering have been denied the plants.²

Both *P. polystachios* and *P. coccineus* show a greater degree of hardiness than members of the *P. vulgaris* assemblage. In England the Scarlet Runner beans sometimes overwinter by means of their tuberous roots, and for the same reason, the Wild Bean of eastern North America has become a perennial species.

These similarities of behaviors and responses that characterize the Wild Bean and the Scarlet Runner assemblage, more especially the hypogean behavior of the cotyledons, would indicate the former is more closely allied with the *P. coccineus* assemblage than to the kidney beans, *P. vulgaris*.

WASHINGTON, D. C.

¹ Complete or Partial Inhibition of Flowering in Certain Plants when Days are too Short or too Long. H. A. Allard, Jour. Agr. Res., 57 (10), 1938.

² Further studies in Photoperiodism, the response of the plant to relative length of day and night. W. W. Garner and H. A. Allard, Jour. Agr. Res. 23, 1923. Effect of length of day on flowering and growth. M. A. H. Tincker. Nature, Sept. 6, 1924, p. 350. Further observations on the responses of various species of plants to length of day. H. A. Allard and W. W. Garner. U. S. Dept. of Agr. Tech. Bull. 727, 1940.

THE BROAD-LEAVED SPECIES OF POTAMOGETON OF NORTH AMERICA NORTH OF MEXICO

E. C. OGDEN

(Continued from page 163)

The following, selected from a very large series of specimens, are representative: LABRADOR: Grand Falls of Hamilton R., *Doutt 3323*. QUEBEC: Lake Mistassini, *J. M. Macoun 3055*; Lac au Saumon, Matane Co., *Svenson & Fassett 3045*; Roberval, July 16, 1892, *Kennedy*; Lac William, near St. Ferdinand, *Louis-Marie, Laporte & Dudemaine 501*; Odanak, Yamaska Co., *Adrien 1806*; Longueuil, Chambly Co., *Victorin 18462*, also *Rolland 43354, 43355, 43356 & 43481*; Isle-aux-Noix, Richelieu R., *Victorin 8179*. MAINE: Beau Lac, valley of St. Francis R., Aug. 14, 1902, *Eggleston & Fernald*; Fish River Lake, Aroostook Co., *Ogden 1717*; Round P., Aroostook Co., *Fellows 2007*; Cross L., Aroostook Co., *Fellows 4887*. VERMONT: Lake Champlain, Orwell, Addison Co., *Cushman 6009*; Big Otter Creek, Ferrisburgh, Aug. 12, 1887, *Morong*; Ferrisburgh, Aug. 16, 1896, *Eggleston*; Swanton, Franklin Co., *Blewitt 2137*; mouth of Winooski R., Burlington, Chittenden Co., Aug. 30, 1903, *N. F. Flynn*, also *Blake 2308*; Rescue L., Ludlow, Windsor Co., July 12, 1906, *Burnham*. MASSACHUSETTS: Pontoosuc L., Lanesboro, Berkshire Co., Sept. 9, 1915, *J. R. Churchill*; Mill R., New Marlboro, Berkshire Co., July 24, 1912, *R. Hoffmann*. NEW YORK: Muska-longe Bay, Lake Ontario, Jefferson Co., *Muenschler & Maguire 1782*; Salmon R., Selkirk, Oswego Co., *Fernald, Wiegand & Eames 14087*; Rapids above Niagara Falls, Aug. 21, 1886, *Morong*; Tioughnioga R., Cortland, Cortland Co., *E. L. Palmer 50*; Silver L., Perry, Wyoming Co., *Burkholder & Muenschler 16424*; Myers Point, Lansing, Tompkins Co., *Jones & Hoffmann 7467*; Cayuga L., July 15, 1879, and Aug. 28, 1884, *Dudley*, also Aug. 15, 1893, *Hermann von Schrenk*, also *Muenschler & Bechtel 459*; Bemus Point, Lake Chautauqua, Aug. 8, 1896, *J. R. Churchill*; Shushan, *Dobbin 1072 & 1327*. PENNSYLVANIA: Brandywine Creek, Chester Co., no date, ex Herb. Wm. M. Canby (F, on a sheet with *P. perfoliatus* var. *bupleuroides*; perhaps the label refers only to *P. perf. v. bup.*). ONTARIO: Spawning L., Temagami Forest Reserve, *Cain 1051*; Lake Nipissing, *Chitty 306*; Agawa R., Lake Superior, *Pease 17983*; Lake Hannah, Nipigon R., July 21, 1884, *John Macoun*; Mississippi R., Galetta, Carleton Co., *Ogden & Bolan 1631*; Hay Bay, Tobermory, Bruce Co., *Krotkov 7041*; Golden L., Renfrew Co., *Macoun 22176*. MICHIGAN: Ontonagon R., 1862, *J. W. Robbins*; Sault Ste. Marie, Aug. 6, 1881, *E. J. Hill*, also Aug. 25, 1882, *Morong*; Lake George, Homestead, Sugar Island, Chippewa Co., *Hermann 7153 & 7224*; Douglas L., Cheboygan Co., *Gates 258*; Lake Charlevoix,

Iron-ton, Charlevoix Co., *Ogden & Bolan* 1678; Thread P., Flint, Aug. 11, 1909, *Sherff*; Detroit R., *Gillman* 65; Black L., Ottawa Co., July 14, 1926, *Oosting*. OHIO: Sandusky Bay, Sept. 2, 1898, *E. L. Mosely*; Painesville, Aug. 21, 1887, herb. *W. C. Werner*, also *Biltmore Herbarium* 688. INDIANA: Wolf L., Whiting, Lake Co., *Deam* 55274A; Hamilton L., Hamilton, Steuben Co., *Deam* 56686; Long L., Wolcottville, Lagrange Co., Aug. 20, 1930, *Johnson & Myers*; Culver Bay, *Scovell & Clark* 1057; Lake Maxinkuckee, *Scovell* 27a, also *Evermann* 1057. WISCONSIN: University Bay, Lake Mendota, Aug. 19, 1912, *R. H. Denniston*; KaKagan R., Ashland Co., *L. S. Cheney* 4919; Port Wing, Bayfield Co., *Fassett* 7535; Oshkosh, 1877, *W. A. Kellerman*; State House, Trout Lake, Vilas Co., *Fassett* 9061; Green Bay, July 28, 1891, *Schuette*. ILLINOIS: Calumet L., Chicago, *Chase* 1421; Lake Michigan, Chicago, Aug. 1860, *Dr. Scammon*. MANITOBA: Brandon, *Macoun* 16459. MINNESOTA: Knife R., Lake Co., *Pease & Bean* 26389; Lake Itasca, Clearwater Co., *Grant & Oosting* 3206; Lake Augusta, Arno Twp., Cottonwood Co., *Hotchkiss & Jones* 3976; Wheeler L., Kandiyohi Co., *Metcalf* 2124; Center City, July 1892, *B. C. Taylor*; Swan L., Nicollet Co., July 1892, *C. A. Ballard*, also *Metcalf* 9; Chisago L., *Metcalf* 1145 & 1176; Rice L., Aitkin Co., *Metcalf* 1463; Lake Koronis, Stearns Co., *Metcalf* 1390, also *Kubichek* 109; Glacier L., Murray Co., *Metcalf* 1839; Linwood L., Anoka Co., *Kubichek* 17; German L., Le Sueur Co., *Shunk & Manning* 220; Mille Lacs L., Mille Lacs Co., *Keck & Stevens* 323; Lake Stewart, Otter Tail Co., *Oosting* 302; Lake Minnetonka, Navarre, *Oosting* 2971. IOWA: Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek*; Spirit L., Dickinson Co., July 31, 1896, *B. Shimek*; L. Okoboji, July 1888, *A. S. H.*; Estherville, July 1881, *R. I. Cratty*. NORTH DAKOTA: Fish L., Bottineau, July 25, 1896, *M. A. Brannon*; St. Mary's L., Valley City, *Mabbott* 251 & 252; Leeds, Benson Co., July 29, 1899, July 24, 1900, July 22, 1906, July 31, 1907 & July 16, 1913, *Lunell*; Pelican L., Turtle Mts., Bottineau Co., *Metcalf* 547; Rush L., Cavalier Co., *Mabbott* 500; L. Wamtah, Foster Co., *Mabbott* 350; Jim L., Pingree, *Mabbott* 317. SOUTH DAKOTA: Lake Hendricks, June 20, 1891, *T. A. Williams*; Lake Campbell, July 4, 1893, *T. A. Williams*; Pickerel L., Day Co., *Over* 14460 & 17134; Clear L., Marshall Co., *Over* 17137; Clear L., Deuel Co., *Over* 3366; Big Stone L., Aug. 26, 1892 & Aug. 10, 1895, *T. A. Williams* (G, NY, S, narrow-leaved form); Big Stone L., Roberts Co., *Over* 14464 (US, narrow-leaved form); Big Stone L., Grant Co., *Over* 3367 (US, semi-narrow-leaved form); Sand L., *Griffiths* 6 (F, G, semi-narrow-leaved form). NEBRASKA: Dewey L. near Valentine, *Tolstead* 429 & 473; 3 miles n. w. of Whitman, Grant Co., *Rydberg* 1792; Enders L., *Thomson* 5; Crescent L., *Thomson* 299; Shafer L., Garden Co., *Uhler & Martin* 1659; Lake Manawa,

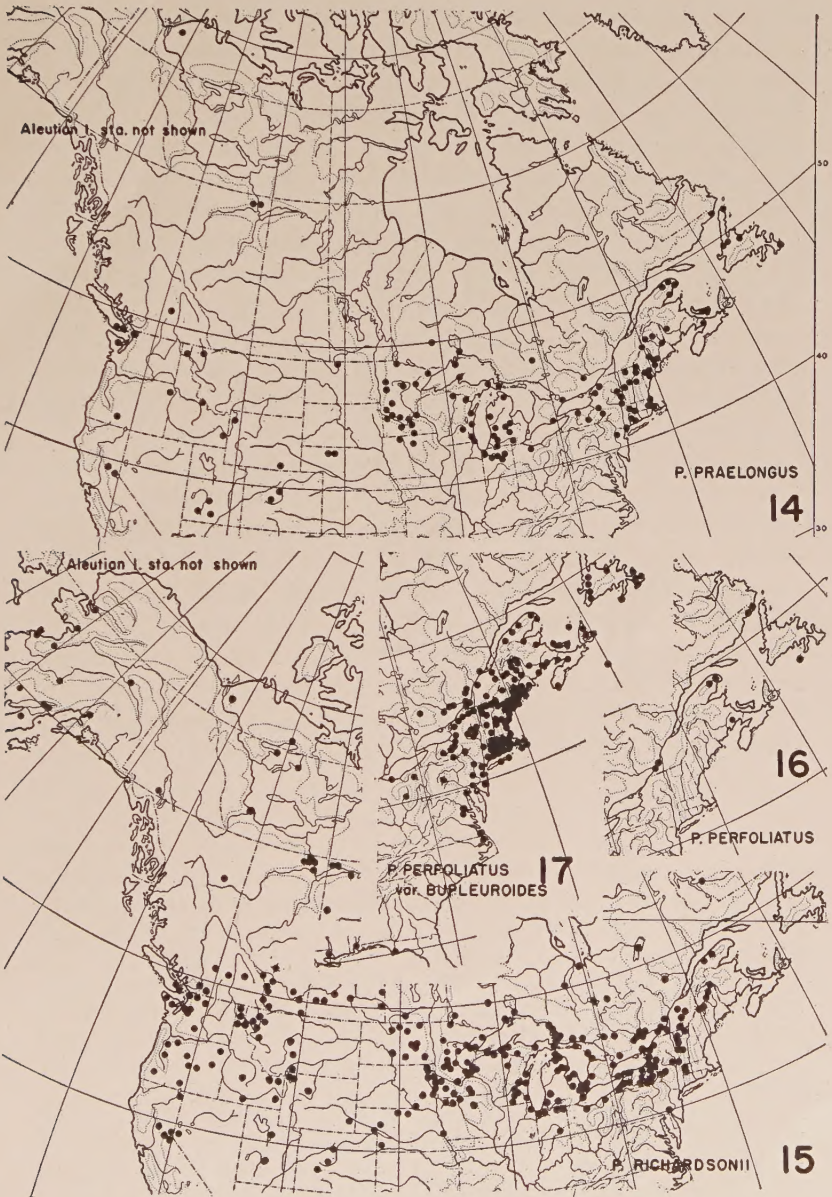
Omaha, *Amy C. Lawton* 53 (F, semi-narrow-leaved form). MACKENZIE: Setidge L., Aug. 21, 1927, *A. E. & R. T. Porsild* 3098; Conquerors Bay, Aug. 15, 1928, *A. E. & R. T. Porsild*; Big Point, Aug. 24, 1928, *A. E. & R. T. Porsild*. SASKATCHEWAN: Yorkton, *Macoun & Herriot* 76872; Eagle L., *Macoun & Herriot* 86871; Methye L., *J. M. Macoun* 4368; near mouth of McFarlane R., Lake Athabasca, *Francis Harper* 98; Cornwall Bay, Lake Athabasca, *Raup* 6617. ALBERTA: Bow River Valley, *Stewardson Brown* 694; near Banff, *Macoun* 4383; Vermilion Lakes, Banff, *John Macoun* 4380, also *Malte & Watson* 960, also *McCalla* 2370; near Chipewyan, n. shore of Lake Athabasca, *Laing* 147; also *Raup & Abbe* 4666. MONTANA: Missoula Valley near Frenchtown, *S. Watson* 397; Flathead L., Polson, Flathead Lake Co., *Muenschner* 10218; Flat Top L., *Maguire* 488; Lower Two Medicine Lakes, *Maguire* 495; Swift Current Ridge L. (Bath Tub), *Maguire* 490; Trout L., Glacier National Park, *Maguire & Piranian* 5440; Midvale, *Umbach* 433; Big Fork, *MacDougal* 805. IDAHO: Lake Pend Oreille near Hope, *Sandberg, MacDougal & Heller* 956; Clarks Fork Valley below Weeksville, *Leiberg* 1574; Blackfoot R., Trail Ranger Station, Bannock Co., *Eggleston* 9974; Henry L., Fremont Co., *E. B. & L. B. Payson* 2023; Mud L., *Sperry & Martin* 671; Snake R., St. Anthony, *Merrill & Wilcox* 863; Portneuf R., McCammon, Bannock Co., *Ray J. Davis* 328-37; Alturus L., *Evermann* 492. WYOMING: Goose Creek L., *Aven Nelson* 2276; Laramie R., *Elias Nelson* 87 & 3362; Lewis L., Yellowstone region, 1878, *C. Richardson*; N. Yellowstone L., *Tweedy* 413. COLORADO: vicinity of Twin Lakes, July-Aug. 1902, *C. Juday*; Tomichi R., Parlin, Gunnison Co., Aug. 20, 1901, *Benjamin H. Smith*; Kremmling, Grand Co., *Beetle* 1462. UTAH: Lehi, Aug. 1883, *M. E. Jones*; Fish L., *M. E. Jones* 5788, also *Rydberg & Carleton* 7522. NEVADA: Truckee R., *Sereno Watson* 1135. CALIFORNIA: Pit R., at Lookout, Modoc Co., Aug. 24, 1899, *M. S. Baker*; Webber L., Sierra Co., Aug. 1894, *Dudley*; Big Meadows, Plumas Co., *Mrs. R. M. Austin* 575; Feather R., *Mrs. R. M. Austin* 1177; Truckee R., alt. 4000 ft., *W. W. Bailey* 1135. OREGON: Des Chutes R., Lupine, Crook Co., *Peck* 9619; Ten-Mile L., near Lakeside, Coos Co., *Peck* 9009; Willamette R., Salem, *Hall* 489 & 490; Willamette R., June 1890, *Drake & Dickson*, also *Henderson* 1009; Strawberry L., Blue Mts., *Cusick* 3620; U. S. R. S. Main Canal, Klamath Falls, Klamath Co., *Applegate* 3416; Laidlaw, Crook Co., *Kirk & Whited* 3141. WASHINGTON: Lake Washington, Mercer Island, King Co., *J. W. Thompson* 7594; Lake Whatcom, Whatcom Co., *Muenschner* 7653; Seattle, June 26, 1889, *E. C. Smith* 757, also Aug. 1892, *C. V. Piper*; Quiniault, *Conard* 318; Prosser, Yakima Co., *Cotton* 809; Stevenson's Ranch, Lake Chelan, *Gorman* 677; Lake Sammamish, King Co., *Otis* 1678; also Aug.

30, 1936, G. N. Jones. BRITISH COLUMBIA: Sicamous, John Macoun 4127; Sumas L., Chilliwack Valley, J. M. Macoun 26817; Cowichan L., Vancouver Island, J. T. Howell 7679; Shuswap L., J. M. Macoun 3049; Howser L., Shaw 771 & 777; Kamloops, John Macoun 3048. YUKON: Lewis R., Lat. 60°, Sept. 6, 1887, Dawson 3046. ALASKA: Unalaklet, A. E. & R. T. Porsild 1102; Votlik, June 10-14, 1926, A. E. & R. T. Porsild; Pastolik, July 16-20, 1926, A. E. & R. T. Porsild; Holy Cross, July 5, 1926, A. E. & R. T. Porsild; False Pass, Unimak Island, Aleutian Islands, Eyerdam 2156; Fairbanks, L. J. Palmer 1862; Ankow R., Piper 4430; Matanuska, J. P. Anderson 838 & 1522; Pyramid Creek, Unalaska, Jepson 238; Selawik L., L. J. Palmer 638 (US, mixed with *P. gramineus* var. *maximus*); Chuletna R., Lake Iliamna, Gorman 233; Naknek L., Point no. 795, Katmai Region, Alaska Pen., July 22, 1919, A. E. Miller; Kotlik, Yukon R. delta, A. E. & R. T. Porsild 847.

P. Richardsonii is closely related to *P. perfoliatus* and is considered by many to be merely a variety or state of that species. Often, on vegetative characters alone, the two species are difficult to distinguish, but with fruiting specimens there is never any question. The larger fruit, borne on clavate peduncles, and always with a cavity in the endocarp loop, is quite distinctive from that of *P. perfoliatus*. In the western part of its range, this plant exhibits the characteristic ovate-lanceolate leaves with the strong white stipule-fibers, and only in the region east of New York state do its leaves and stipules approach those of *P. perfoliatus*. As intermediate specimens are nearly always sterile and scarcely found except where the ranges of *P. Richardsonii* and *P. perfoliatus* var. *bupleuroides* overlap, it is reasonable to suppose that they are hybrids of these two closely related plants.

In many respects *P. Richardsonii* is intermediate between *P. praelongus* and *P. perfoliatus* and Hagström suggested that it "has arisen by cooperation between these two species."¹ It is however a fertile species (for a *Potamogeton*) and with its greatest development falling outside the range of *P. perfoliatus* it certainly cannot be considered a recent hybrid. The anatomy of its stem is exactly that of *P. perfoliatus* and strikingly different from that of *P. praelongus*. It would seem that if *P. praelongus* were involved in its origin it would retain some of the fundamental anatomical characteristics of that species, especially the

¹ J. O. Hagström, Crit. Res. Pot. 254 (1916).



RANGES OF POTAMOGETON

cortical bundles and a tendency to the prototypic stele. It would seem more logical to suppose that *P. praelongus* evolved from a *perfoliatus*-like ancestor, with *P. Richardsonii* as an intermediate step, except that *P. Richardsonii* is confined to North America (reported from Scotland¹), while both *P. perfoliatus* and *P. praelongus* have a much wider distribution. Also such a postulate would involve the development of a proto-type stelar pattern from a trio-type pattern. The fossil record is of little or no help here, for both *P. perfoliatus* and *P. praelongus* appear for the first time in the Amber flora (Upper Eocene or Lower Oligocene) of Denmark,² and *P. Richardsonii* is not distinguished from *P. perfoliatus* in fossil literature. In America, members of the perfoliate-leaved species are reported only from the Pleistocene, near Ottawa, Canada.³

A narrow-leaved form of *P. Richardsonii* is found in Big Stone Lake, between northern South Dakota and Minnesota. It was collected there by T. A. Williams in 1892 and in 1895 and by W. H. Over in 1922 (no. 14464). Another collection from the same lake (*Over* 3367) and collections from Sand Lake, South Dakota (*Griffiths* 6) and Lake Manawa, near Omaha, Nebraska (*Lawton* 53) appear to be nearly the same thing, and several other collections approach it. This form might be considered a variety were it not that typical *P. Richardsonii* frequently produces narrow-leaved branches, especially in deep or moving water.

13. *P. PERFOLIATUS* Linnaeus

RHIZOME whitish or pinkish, not spotted. STEM terete, .4–2 mm. in diameter, often much branched; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle usually appearing as 2 patches; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis 1 cell thick, at least partly so. LEAVES all submersed, delicate, orbicular to ovate-lanceolate, usually ovate, 1–6 (–7) cm. long, .5–3 cm. wide, nerves 7–21, not strongly developed, only 1–7 of them prominent, cordate at base and clasping about $\frac{3}{4}$ the circumference of the stem; apex rounded or at least broadly obtuse; margin with fugacious 1-celled translucent denticles which are usually divergent, lacunae of 1–3 rows of cells each side of the midrib.

¹ Arthur Bennett, *Journ. Bot.* 19: 241 (1881).

² N. Hartz, *Danmarks geologiske Undersogelse*, 2: no. 20: 121 (1909).

³ J. W. Dawson, *Can. Nat. n. ser.*, 3: 72 (1868).

STIPULES delicate, membranous, translucent, often appressed to the stem and seemingly a part of it, fugacious, ovate-oblong, rounded at apex, .4–2 cm. long, without keels. PEDUNCLES about same thickness as stem, 1–9 cm. long. SPIKES with 2–8 whorls, not crowded at anthesis, sometimes moniliform; in fruit 1–2 cm. long, and about .8 cm. thick. FLOWERS sessile or on short pedicels up to .5 mm. long; sepaloid connective greenish, blades orbicular or elliptical, (1.2–) 1.4–1.9 (–2.3) mm. wide, claws .7–1.3 mm. long; anthers (.7–) .9–1.2 (–1.3) mm. long. FRUITS obovate, rounded on the back and at base, sides plump when mature, (2.3–) 2.5–2.7 (–3) mm. long (excluding beak), (1.7–) 2–2.1 (–2.3) mm. wide; beak usually prominent, up to .7 mm. long; keels rounded or none; exocarp usually gray-green or olive-green; endocarp with rounded keels, beak linear, facial, about .5 mm. long, loop solid; apex of seed pointing toward the basal end. Plants characterized by numerous, ovate, perfoliate, submersed leaves, with delicate weakly-nerved fugacious stipules.

Two varieties differing only in size but strongly marked as to their extreme variation:

- Stem 1–2 mm. in diameter; leaves 1.5–3 cm. wide, 11–21 nerves,
 5–7 of them prominent.....13a. var. *typicus*.
 Stem .4–1.5 mm. in diameter; leaves .5–2 cm. wide, 7–17 nerves,
 1–5 of them prominent.....13b. var. *bupleuroides*.

13a. *P. PERFOLIATUS* L. var. *typicus*

P. perfoliatus L., Sp. Pl. 1: 126 (1753); Morong, Mem. Torr. Club 3: no. 2: 33 (1893), in small part; Graebn. in Engler, Pflanzenr. 4: fam. 11: 92 (1907), in part; Taylor, N. Am. Fl. 17: pt. 1: 22 (1909), in small part; Hagstr., Crit. Res. Pot. 254 (1916). *P. perfoliatus* var. *gracilis* Am. auth., in part; perhaps C. & S., Linnaea 2: 190 (1827). *Spirillus perfoliatus* Nieuwl., Am. Mid. Nat. 3: 17 (1913).

Rivers and lakes, southern Labrador, Quebec, and New Brunswick. MAP 16. Eurasia, northern Africa, Australia. The following are referred here: LABRADOR: Blanc Sablon R., Straits of Belle Isle (also on the Quebec side of the river), *Fernald, Wiegand & Long 27348*; Blanc Sablon R., Straits of Belle Isle, *Fernald & Wiegand 2450*. QUEBEC: Blanc Sablon R., Brest, Saguenay Co., *St. John 90087*; Blanc Sablon R., Blanc Sablon, Saguenay Co., *Lewis 130397*; Lac Pleureuse, Gaspé Co., *Fernald, Dodge & Smith 25421*; L'Île Plate, Longueuil, near Montreal, *Victorin 20454*. NEW BRUNSWICK: Kennebecasis R., Lakeside, Kings Co., *Svenson & Fassett 933*.

13b. *P. PERFOLIATUS* L. var. *BUPLEUROIDES* (Fernald) Farwell

P. bupleuroides Fern., RHODORA 10: 46 (1908); Hagstr., Crit. Res. Pot. 258 (1916). ?*P. crispus* sensu Darlington, Fl. Cestr.

23 (1826); not L., Sp. Pl. 1: 126 (1753). *P. perfoliatus* sensu Morong, Mem. Torr. Club 3: no. 2: 33 (1893), in great part; sensu Graebn. in Engler, Pflanzenr. 4: fam. 11: 92 (1907), in part; sensu Taylor, N. Am. Fl. 17: pt. 1: 22 (1909), in part. *P. perfoliatus* var. *bupleuroides* Farw., Am. Mid. Nat. 8: 264 (1923).

Brackish or fresh ponds and quiet rivers, Newfoundland to Florida, west to Ontario, Ohio, and Louisiana, common only in the northeastern part of its range. MAP 17. Also Guatemala (Lake Atitlan, 1906, *C. M. Barber*) and probably elsewhere in Central America. The following are selected from a large series of specimens: NEWFOUNDLAND: Killigrew's, Conception Bay, Avalon Peninsula, *Fernald & Wiegand* 4484; Holyrood, *Robinson & Schrenk* 207 (G, TYPE of *P. bupleuroides*, C, F, M, NY, US, isotypes); near Frenchman's Cove, Bay of Islands, *Mackenzie & Griscom* 10049; St. Georges, *Fernald, Wiegand & Kittredge* 2451; Highlands P., Crabbes, *Kennedy* 551; Topsail, *Williamson* 472. ST. PIERRE ET MIQUELON: Miquelon, *Louis Arsène* 40 & 43. QUEBEC: Percé, *Victorin, Brunel, Rolland & Rousseau* 17286; Newport, Gaspé Co., *Victorin, Rolland & Jacques* 44467; Dartmouth R., Gaspé Co., *Collins, Fernald & Pease* 5578; Saint-Augustin, Portneuf Co., *Victorin, Rolland & Jacques* 33879; St. Lawrence R., St. Vallier, Bellechasse Co., *Senson & Fassett* 3031; Ile Plate, St. Lawrence R., Longueuil, *Victorin* 8178 & 20456; near Ottawa, *Victorin* 10104. MAGDALEN ISLANDS: Cap-aux-Meules, Ile de l'Étang-du-Nord, *Victorin & Rolland* 9924; Étang-du-Nord wharf, Grindstone Island, *Fernald, Long & St. John* 6771. PRINCE EDWARD ISLAND: Tignish, *John Macoun* 3043; Lower Sea Cow P., Prince Co., *Fernald, Long & St. John* 6770; Black P., Kings Co., *Fernald, Bartram, Long & St. John* 6769. NEW BRUNSWICK: Restigouche R., Restigouche Co., *Svenson & Fassett* 932; Nipisiquit R., Bathurst, Gloucester Co., *Blake* 5483; St. John R., Westfield, Kings Co., *Fernald* 1610 & 1611; also *Fassett* 2148; Bass R., Kingston, Aug. 13, 1874, *J. Fowler*. NOVA SCOTIA: South Ingonish, Cape Breton Island, *Nichols* 694; Mira Bay, Cape Breton Island, *Macoun* 20756; Bevis Brook, Port Bevis, Victoria Co., *Fernald & Long* 19694; Salmon R., Truro, Colchester Co., *Bean & White* 19696; Truro, Colchester Co., *Prince & Atwood* 1405; Port Clyde, Shelburne Co., *Fernald & Long* 23143; Midway (Centreville) L., Centreville, Digby Co., *Graves & Linder* 19693; Sable Island, *St. John* 1124. MAINE: Mattawamkeag L., Island Falls, Aroostook Co., Sept. 7, 1897, *Fernald*; also *Pease & Hopkins* 22692; also *Steinmetz* 374; Pushaw P., Glenburn, Penobscot Co., *Ogden & Steinmetz* 1544; Bradley, July 29, 1905, *Ora Knight*; Souadabscook Stream, Hampden, Penobscot Co., *Fernald & Long* 12392; Eagle L., Piscataquis Co., *Ogden* 1701; Indian P., St. Albans, Somerset

Co., *E. C. & E. B. Ogden* 2008; South Paris, Oxford Co., 1897, *Furbish*; Roque Bluffs, Washington Co., Aug. 6, 1932, *Knowlton*; Mt. Desert I., Hancock Co., many collectors; Winterport, Waldo Co., *Rosbach* 77; Thomaston, Knox Co., Aug. 15, 1913, *E. B. Chamberlain*; also Aug. 14, 1915, *A. H. Norton*; Sheepscot R., Alna, Lincoln Co., *Fassett* 456; Sydney, Kennebec Co., *Fernald & Long* 12391; Topsham, Merrymeeting Bay, Sagadahoc Co., *Steinmetz* 526; Scarboro, Cumberland Co., *Fellows* 4679; Old Orchard, York Co., *Fernald* 1612; also *Chamberlain & Knowlton* 571; also *Parlin* 1073; also *Fellows* 2966. NEW HAMPSHIRE: Connecticut R., Northumberland, Coös Co., *Pease* 12143; Melvin, Merrimack Co., Aug. 15, 1904, *M. A. Day*; also *Sargent* 29; Rye Beach, Rockingham Co., Aug. 24, 1886, *Walter Deane*; Smith R., Danbury, Merrimac Co., Aug. 23, 1933, *Charles Bullard*; Rollinsford, *Hodgdon* 11. VERMONT: Maidstone, Essex Co., *Sanford* 1225; Willoughby L., Aug. 31, 1917, *E. J. Winslow*; Missisquoi R., Swanton, Franklin Co., *Blewitt* 4319; Missisquoi R., Sheldon, Franklin Co., *Blewitt* 4320; Pelot's Bay, Lake Champlain, Aug. 2, 1899, *Nellie F. Flynn*; also *Carpenter* 6069; Winooski R., Essex Junction, Chittenden Co., *Blake* 2212; Winooski R., Montpelier, Washington Co., *Svenson & Fassett* 3040. MASSACHUSETTS: Chadwick's P., Haverill, Essex Co., *Harris* 540; Mystic P., Medford, Middlesex Co., many dates, *Morong*; Fresh P., Cambridge, Middlesex Co., many collectors; Wareham, Plymouth Co., *Svenson & Smith* 822; Mashpee, Barnstable Co., *Fogg* 3606; Tashmoo L., Tisbury, Dukes Co., Marthas Vineyard, *Seymour* 1027; Marthas Vineyard, *McAtee* 1060; Washing P., Nantucket Island, *Bicknell* 118; also Sept. 8, 1909, *J. R. Churchill*; Congamond P., Southwick, Hampden Co., *Seymour* 267; Horse P., Westfield, Hampden Co., *Markert* 76909; Housatonic R., Stockbridge, Berkshire Co., Aug. 20, 1902, *R. Hoffmann*. RHODE ISLAND: Roger Williams Park L., Providence Co., July 23, 1908, *T. Hope*; Little Compton, Newport Co., *Sanford* 10192; Wash P., Block Island, Newport Co., *Fernald, Hunnewell & Long* 8445. CONNECTICUT: Selden's Cove, Lyme, New London Co., Sept. 6, 1911, *E. B. Harger*; Paton Brook, Southington, Hartford Co., Aug. 28, 1900, *C. H. Bissell*; Fenwick, Middlesex Co., Sept. 2, 1884, *C. Wright*; East Haven, New Haven Co., *Blewitt* 1677 & 1978; Pistapaug P., Wallingford, New Haven Co., *Blewitt* 3651; Ash Creek, Fairfield, July 6, 1895, *E. H. Eames*. NEW YORK: White Creek, De Kalb, *Phelps* 1092 & 1655; Rockland L., Rockland Co., *Muenschner & Curtis* 5436; Onondaga L., Aug. 1, 1890, *L. M. Underwood*; Schroon L., Warren Co., *Muenschner & Lindsey* 2728; Round L., Saratoga Co., *Muenschner & Clausen* 4210; n. of Canoga Marshes, Cayuga L., Seneca Co., *Eames & Wiegand* 9102; Riverhead, Southampton, Suffolk Co., *St. John* 2542. NEW JERSEY: Mantoloking, Ocean Co., *Edwards*

& Clausen 1400; Barnegat Bay, 1852, *O. R. Willis*; New Durham, July 21, 1864, *W. H. Leggett*; Hackensack R., Oradell, Oct. 10, 1891, *Morong*; Swartswood L., Sussex Co., *Griscom & Mackenzie 10680*. PENNSYLVANIA: Delaware R., Bushkill, Pike Co., Aug. 4, 1918, *E. B. Bartram* (G). DELAWARE: Brandywine, Wilmington, Aug. 17, 1896, *A. Commons* (M, NY). MARYLAND: off mouth of Mill Creek, Chesapeake Bay Region, *Shull 96*; Carroll Island, *Coville 114 & 118*; Oxon Run, *Tidestrom 7175*; Pomonkey Creek near Potomac R., June 24, 1906, *Tidestrom*; Rock Point, Charles Co., *Leonard & Killip 863*. VIRGINIA: Four Mile Run, Chesapeake Bay Region, *Shull 469*; Four Mile Run, Alexandria, Sept. 23, 1903, *Tidestrom*; Aquia Creek, Aug. 12, 1930, *Hugh O'Neill*; Dyke, Fairfax Co., *Metcalf & Sperry 1603*; Back Bay, Long Island, Princess Anne Co., *Fernald & Long 10873* (locally called "Red-top"). NORTH CAROLINA: North Channel, Currituck Sound, *Shull 456* (G, M, NY, US). FLORIDA: Apalachicola, no date, herb. *Chapman* (G, NY). ONTARIO: Almonte, July 7, 1898, *J. Fowler* (F); Cache L., Algonquin Park, *Macoun 22227* (C, not typical). OHIO: Put-in-Bay, Aug. 1898, *A. J. Pieters* (US); Ohio Canal near Roscoe, *J. L. Riddell* (G, US). ALABAMA: Mobile, July 1884, *C. Mohr* (S, US). LOUISIANA: Chifuncte Lighthouse, Lake Ponchartrain, Aug. 16, 1838, *Riddell* (US).

P. perfoliatus exhibits such an amount of variation that one might suppose it to include many varieties, yet these variants grade so insensibly into each other that lines can scarcely be drawn. Here, however, one is justified in refusing to give the variants formal rank, for they are sometimes found coming from the same rhizome, or as branches of the same plant.

In America, two extremes appear to deserve varietal recognition. One of these, a plant sparingly found in the cooler parts of northeastern North America, cannot be distinguished from *P. perfoliatus* of Europe. It approaches var. *gracilis* C. & S., which, being based entirely on variable foliage-characters, scarcely merits recognition as a genetic entity. Our plant is considered to be var. *typicus*. The few specimens from North America are all sterile. The other variety in North America is a smaller plant, with slender stem and delicate leaves having few prominent nerves. It is abundant from Newfoundland to New York and fruits freely. This latter plant has been separated from *P. perfoliatus* as *P. bupleuroides*. In its typical development in the brackish ponds of eastern Massachusetts, this plant differs so strikingly in size from the robust typical variety that, were it

not for the transitional forms so common in Maine, Quebec, and New York, it might well be regarded as a separate species.

In view of the fact that typical *P. perfoliatus* of Europe may have branches with foliage matching that of the variety *bupleuroides*, and that in patches of the latter variety there may occasionally be found plants bearing robust leaves approaching those of the typical variety, it seems best to treat them both as variants of the same species. Any differences in the fruits of var. *bupleuroides* and var. *typicus* of Europe are too slight and inconsistent to be used for distinguishing the varieties.

The remarks of Fryer as to the variability of *P. perfoliatus* in Europe are of importance here:

Potamogeton perfoliatus has so considerable an amount of variation both in the shape and colour of the leaves that at first sight it seems easily separable into distinct varieties, but the examination of a good series, even of dried specimens, shows that the most extreme forms pass into one another so gradually that they are probably nothing more than *states* produced by local and often temporary conditions. An isolated plant growing in a newly dug clay pit afforded unusually good opportunities for observation during several years, and this plant changed so much in the shape, colour, and even texture of the leaves, that I am further induced to think that all our British forms are mere states, not true varieties. When first noticed this single plant was very small, apparently a seedling of the year, and the leaves were elongated, thin, and diaphanous, After three or four years the whole plant grew coarser in texture and the leaves were more horny, Ultimately the plant spread and occupied a considerable part of the little pit in which it grew, and became so like the ordinary state of the species that I ceased to observe it, thinking that it had afforded sufficient proof that the texture and shape of the leaves are too inconstant to afford satisfactory grounds for varietal distinction.¹

Mrs. Arber took a typical shoot of *P. perfoliatus* in July and kept it floating in a rain-water tub. "By October 1 most of the large perfoliate leaves had decayed and those on the new shoots were so much narrower and less perfoliate as to make it difficult to believe that they belonged to the same species."²

The work of the Pearsalls³ with this species is very illuminating. Their ecological observations and experiments with plants of lakes and on those grown in tanks, led them to the conclusion that light intensity played a very great part in the shape of the leaf. However, leaf-shape was also influenced by other factors;

¹ Alfred Fryer, *Pot. Brit.* Isles 41 (1900).

² Agnes Arber, *Water Plants* 58 (1920).

³ W. H. Pearsall & W. H. Pearsall, *Journ. Bot.* 61: 2 (1923).

the nature of the soil probably being the primary one. Plants on calcareous soil tended to have broader leaves than those of acid waters. In America var. *bupleuroides* appears to vary according to the chemical nature of the water. Plants of brackish water invariably have small ovate leaves; those of neutral or acid waters tend to have their leaves larger and of a more elongate shape.

HYBRIDS

As nearly all *Potamogeton*-hybrids lack fruit and as flowers among the broad-leaved species are of slight, if any, value in distinguishing entities, it is necessary to base one's opinions as to the probable parents on the characters of the leaves and the anatomy of the stem. It is important that both parents be found in the general vicinity of the hybrid they are supposed to have produced, though there is some question if this needs to be so, for such a hybrid may reproduce vegetatively and persist for long periods of time, sometimes, perhaps, after a parent has ceased to exist in that vicinity. Although interspecific hybrids (except *P. gramineus* \times *illinoensis*) seem not to form mature fruit, they often produce pollen, some of which appears to be viable. It is suspected that in this way they backcross with the parents, producing plants which strongly simulate a given species, but show evidences of influence from some other species. In some such cases one parent can be named with assurance, the other with less confidence. In many such cases it seems wisest to correlate the plant with the species to which it shows the strongest affinity, even though in some minor details it does not agree with the normal development of the species with which it is placed. Unless this be done, the number of hybrids might be so great as to make a treatment unwieldy. It may well be that hybrids backcrossing with the parents will eventually supplant one or both parents, which will then not be found in the immediate vicinity of the hybrid.

Hybrids should be considered, not as taxonomic units in themselves, but as blends of two (or more) distinct entities. Most hybrids cannot be described, except by saying "intermediate between the parents." No attempt is made, except where quite obvious, to determine what variety of a species is the parent, nor is attempt made to designate which is the female and which the

male parent. For many collections both parents could not be definitely determined. Most of these are, however, cited and in some cases discussed under the hybrid that is most probable, as determined from herbarium sheets. I hope that collectors who are acquainted with some of the cited localities will observe the plants in the field, for it is among the growing plants that hybrids can be more easily recognized and their parents determined.

P. ALPINUS × NODOSUS

P. alpinus × *nodosus* (× *P. subobtusus*) Hagstr., Crit. Res. Pot. 147 (1916). Not *P. alpinus* × *americanus* (× *P. rectifolius*) Bennett, Journ. Bot. 40: 147 (1902); nor Graebn. in Engler, Pflanzenr. 4: fam. 11: 132 (1907). Not *P. alpinus* × *americanus* (× *P. Faxoni*) Robinson & Fernald in Gray, Man. ed. 7: 73 (1908). Not *P. Faxoni* Morong, Mem. Torr. Club 3: no. 2: 22 (1893); nor Taylor, N. Am. Fl. 17: pt. 1: 20 (1909). Not × *P. Faxoni* Bennett, Journ. Bot. 46: 248 (1908). Not *P. alpinus* var. *Faxoni* Stevens, Ill. Guide to Fl. Pl. 96 (1910).

This hybrid is extremely difficult to recognize for seldom are both parents obvious and the stem-anatomy of the two is so similar that it is of little help except to exclude from the parentage all species with dissimilar anatomy of the stem. Hagström cites but one specimen, which, then, is the type of × *P. subobtusus*: “‘Nov. Ebor.’, E. Tuckerman Jr (hb. Upps.).” Material in the Gray Herb. and New York Bot. Gard. Herb., which is probably isotypic, may well be this hybrid; both are mixed with typical *P. alpinus* var. *tenuifolius*. Other collections which may be this hybrid are: NEW YORK: in a canal or raceway at Niagara Falls, Aug. 21, 1886, *Morong* (G); Niagara R., Aug. 23, 1886, *Coville* (US); Normans Kill, Kenwood, *C. H. Peck* 2 (US).

P. ALPINUS × GRAMINEUS

?*P. alpinus* × *gramineus* (× *P. nericius*) Hagstr., Crit. Res. Pot. 145 (1916).

No American specimens can be cited that are undoubtedly this hybrid. However, plants growing in Mattagodus Stream, Prentiss, Penobscot Co., MAINE, which I studied and collected (*Ogden & Wright* 2342) may possibly be this hybrid. It grew in close proximity to *P. alpinus* v. *tenuifolius* and *P. gramineus*. It is, however, more likely to be *P. gramineus* × *P. perfoliatus* var. *bupleuroides*; the latter species was not found in the im-

mediate vicinity, but is plentiful in the region. Other collections that might belong here are: Churchill, MANITOBA, *Polunin 2070* (C, G, this might be *P. gramineus* × some linear-leaved species. *P. gramineus* is quite obviously a parent, but there are no interlacunar bundles in the stem, and the reddish color suggests *P. alpinus*); Okanogan R., WASHINGTON, *Sereno Watson 396* (G); Catfish L., Algonquin Park, ONTARIO, *Macoun 22220* (C). Collections from QUEBEC: Hull Brook, *Harrington 99100*; Brigham's Creek, Hull, *John Macoun 85531*; also *Malte 118259, 118260, 118261 & 118262*, may be this hybrid.

P. AMPLIFOLIUS × *ILLINOENSIS*

?*P. amplifolius* × *illinoensis* (× *P. scoliophyllus*) Hagstr., Crit. Res. Pot. 164 (1916); ? × *P. scoliophyllus* forma *barensis* Hagstr., *ibid.*

Hagström cites a specimen from Bear Lake, Manistee, MICHIGAN, collected by Morong in 1882 as the type for × *P. scoliophyllus*, and on the supposition that a form might someday be found differing from this, further named the Bear Lake plant: forma *barensis*. None of the collections of Morong from Bear Lake, Manistee, Mich. that I have seen appears to be this hybrid, though both *P. amplifolius* and *P. illinoensis* are represented. Hagström reports this hybrid also from Cedar Lake, Ont. and Buckingham, Que., but cites no specimens. I have seen no specimen that I would refer here.

P. AMPLIFOLIUS × *PRAELONGUS*

Collections that may be this are: WISCONSIN: Green Bay, sloughs between Halfway Slough and Bass Channel, June 29, 1890, *J. H. Schuette* (F); Green Bay, between Duck Creek Channel and Bars Channel, nearer to the latter, July 17, 1890 (or 1899?), *J. H. Schuette* (F); Green Bay, June 23, 1891, *J. H. Schuette* (F). NEW YORK: very abundant, Southeast Bay, Saratoga L., Saratoga Co., *Muenschler & Lindsay 2814b* (G). VERMONT: Tinmouth P., Tinmouth, Aug. 5, 1907, *G. G. Kennedy* (G).

P. AMPLIFOLIUS × *RICHARDSONII*

A collection from the north end of Tupper L., Franklin Co., NEW YORK, *Muenschler & Clausen 3784* (G), may be this hybrid.

P. EPIHYDRUS var. *NUTTALLII* × *PULCHER*

VIRGINIA: outlet of Lee's Millpond, Isle of Wight Co., *Fernald & Long 12230* (G).

P. NATANS × *NODOSUS*

? × *P. perplexus* (*nodosus* × *natans*), Benn., Trans. & Proc. Bot. Soc. Edinburgh **29**: 53 (1924).

Bennett considers a collection from: BRITISH COLUMBIA: Sumas L., Chilliwack Valley, *J. M. Macoun 26815* to be this hybrid and makes it the type of × *P. perplexus*. It may be this, but from the three sheets in the National Museum of Canada (TYPE), the Gray Herbarium, and the New York Botanical Garden, it appears to me to be a typical *P. illinoensis*.

P. GRAMINEUS × *NODOSUS*

? × *P. argutulus* Hagstr., Bot. Not. 106 (1908); Hagstr., Crit. Res. Pot. 220 (1916). ? × *P. argutulus* formseries *nodosifolius* Hagstr., Bot. Not. 106 (1908); ? Hagstr., Crit. Res. Pot. 220 (1916).

The following may belong here: MAINE: Merrymeeting Bay, Topsham, Sagadahoc Co., *Steinmetz 527* (G, ME, O); Sunkhaze Stream, Milford, Penobscot Co., *Ogden & Steinmetz 1607* (O). NEW HAMPSHIRE: Connecticut R., Cornish, Sept. 2, 1886, *F. H. Knowlton* (US). NEW YORK: Spencer L., Spencer, Tioga Co., *Thomas 1494* (G); east shore of Hudson R., above Coveville, Washington Co., *Muenschler & Lindsey 2715* (O). DISTRICT OF COLUMBIA: in the vicinity of Washington, Aug. 5, 1879, *L. F. Ward* (US). WEST VIRGINIA: Greenbrier R., Talcott, Summers Co., *Morris 1343* (F, US, possibly *P. illinoensis* × *nodosus*).

P. ILLINOENSIS × *NODOSUS*

P. alpinus × *pensylvanicus* Benn., Journ. Bot. **28**: 301 (1890). *P. Faxonii* Morong, Mem. Torr. Club **3**: no. 2: 22 (1893); Graebn. in Engler, Pflanzenr. **4**: fam. 11: 75 (1907); Taylor, N. Am. Fl. **17**: pt. 1: 20 (1909). ? *P. lonchites* × *rufescens* Morong, Mem. Torr. Club **3**: no. 2: 22 (1893). ? *P. alpinus* × *Claytonii*, Graebn. in Engler, Pflanzenr. **4**: fam. 11: 75 & 132 (1907). × *P. Faxonii* = *P. americanus* × *pensylvanicus* Benn., Journ. Bot. **46**: 248 (1908). × *P. champlainii* = *P. alpinus* × *pensylvanicus* Benn., Journ. Bot. **46**: 248 (1908). × *P. Faxonii* = *P. alpinus* × *americanus* Robinson & Fernald, Gray Man. ed. 7: 73 (1908). *P. alpinus* var. *Faxonii* Stevens, Ill. Guide to Fl. Pl. 96 (1910). *P. illinoensis* × *nodosus* Hagstr., Crit. Res. Pot. 200 (1916). *P. lucens* × *nodosus* (× *P. subrufus*) Hagstr., Crit. Res. Pot. 241 (1916).

The following are referred here: QUEBEC: Ile Bizard, *Adrien 1442* (G, MT). VERMONT: Little Otter Creek, Ferrisburg, Aug. 10, 1880, *C. E. Faxon* (G, MSC, NE, NY, US, type of *P. Faxonii* in NY); Aug. 20, 1880, *C. E. Faxon* (G, NE); Little Otter Creek, near Barnum's Mill and Ferrisburg Station, Ferrisburg, Aug. 19,

1882, *Edwin Faxon* (G, NE, NY), Aug. 23, 1882, *Edwin Faxon* (F, G, NE, NY): Otter Creek, below Vergennes, Addison Co., Aug. 24, 1882, *Edwin Faxon* (NE); Otter Creek, Middlebury, Sept. 5, 1896, herb. *Ezra Brainerd* (G); Little Otter Creek, near Lake Champlain, Ferrisburg, Addison Co., *Ogden & Bolan 1589* $\frac{1}{2}$ (G); Lewis Creek, Ferrisburg, Aug. 20, 1881, *E. & C. E. Faxon* (G, US), Aug. 18, 1882, *Edwin Faxon* (F, G, NY, isotypes of \times *P. champlainii*). NEW YORK: Lake Champlain, Plattsburg, Aug. 19, 1885, *Morong* (C, G, NY); outlet of Lake Seneca, Geneva, Aug. 14, 1884, *Morong* (C, G, NY, cotype collection of \times *P. subrufus*). VIRGINIA: northeast part of Four-mile Run, Chesapeake Bay region, *Shull 471* (G, NY, US). MISSOURI: Cooley L., Clay Co., *Metcalf 1055* (US). TEXAS: Cebelo Creek, near Boerne, Kendall Co., *E. J. Palmer 12907* (G, NY, US, possibly not this hybrid). IDAHO: Altmas L., *Evermann 490* (F, possibly not this hybrid).

P. NODOSUS \times RICHARDSONII

\times *P. rectifolius* (*americanus* \times *alpinus*) Benn., Journ. Bot. **40**: 147 (1902); Graebn. in Engler, Pflanzenr. **4**: fam. 11: 132 (1907); Robinson & Fernald, Gray Man. ed. 7: 73 (1908). *P. americanus* Taylor, N. Am. Fl. **17**: pt. 1: 19 (1909), in part. *P. nodosus* \times *Richardsonii* Hagstr., Crit. Res. Pot. 148 (1916).

ILLINOIS: Railroad ditch, Stoney Island, Chicago, Sept. 14, 1900, *E. J. Hill 171.1900* (NY, isotype material of \times *P. rectifolius*), Aug. 30, 1901, *Hill 179.1901* (C, isotype material of \times *P. rectifolius*), Sept. 6, 1902, *Hill 191.1902* (G), also *Agnes Chase 1477* (F) & *1994* (F). OREGON: Sauvie's Island, *Thomas Howell 1497* (US).

P. EPIHYDRUS \times NODOSUS

? *P. americanus* \times *pensylvanicus* Benn., Journ. Bot. **46**: 250 (1908); not Benn., Journ. Bot. **46**: 248 (1908). *P. nodosus* \times *Nuttallii* (\times *P. subsessilis*) Hagstr., Crit. Res. Pot. 190 (1916).

Bennett mentions ". . . specimens gathered in New York and eastern Massachusetts by the late Dr. Morong . . . " and Hagström cites what may be the same Massachusetts collection. From Hagström's description and an examination of the specimens, it is obvious he refers to Morong's collection from Winchester, MASSACHUSETTS, Sept. 1, 1880 (NY), Aug. 8, 1881 (C, NY), Aug. 29, 1881 (G, 2 sheets, one mixed with *P. nodosus*), which is quite probably this hybrid.

P. GRAMINEUS \times NATANS

? *P. natans* \times *gramineus* (\times *P. sparganifolius*) Hagstr., Crit. Res. Pot. 197 & 217 (1916).

Hagström cites: Pine Plains, NEW YORK, *Hoysradt*. What may be the same collection appears to me to be *P. gramineus*.

P. GRAMINEUS × *ILLINOENSIS*

P. Proteus Zizii C. & S., *Linnaea* 2: 201 (1827), in part. *P. gramineus* var. ? *spathulaeformis* Robbins in Gray, *Man.*, ed. 5: 487 (1867); not sensu Fern., *RHODORA* 23: 190 (1921), nor *RHODORA* 35: 130 (1933). *P. heterophyllus* forma *maximus* Morong, *Mem. Torr. Bot. Club* 3: no. 2: 25 (1893), in part. *P. spathulaeformis* Morong, *Mem. Torr. Club* 3: no. 2: 26 (1893); Graebn. in Engler, *Pflanzenr.*, 4: fam. 11: 91 (1907), as *P. spathuliformis*. *P. spathulaeformis* Tuckerm. in herb., Robbins in Gray's *Man.* ed. 5: 487 (1867), as a synonym; Benn., *Journ. Bot.* 38: 130 (1900). × *P. spathulaeformis* Fern., *RHODORA* 8: 224 (1906); Robinson & Fern. in Gray, *Man.*, ed. 7: 74 (1908). *P. varians* Fryer, *Journ. Bot.* 27: 308 (1889), as to American specimens. ? *P. Zizii* var. *porrectifolius* Benn. ex Graebn. in Engler, *Pflanzenr.* 4: fam. 11: 83 (1907). ? *P. Zizii* var. *gracilis* Benn. ex Graebn. in Engler, *Pflanzenr.* 4: fam. 11: 83 (1907). ? *P. gramineus* × *Zizii* (× *P. spathuliformis*) Graebn. in Engler, *Pflanzenr.* 4: fam. 11: 136 (1907). *P. angustifolius* Taylor, *N. Am. Fl.* 17: pt. 1: 18 (1909), in part. *Spirillus Zizii* Nieuwland, *Am. Mid. Nat.* 3: 17 (1913), in part. *P. illinoensis* × *lucens* (× *P. pseudolucens*) Hagstr., *Crit. Res. Pot.* 199 (1916). *P. gramineus* × *illinoensis* (× *P. deminutus*) Hagstr., *Crit. Res. Pot.* 209 (1916). *P. gramineus* × *illinoensis* × *lucens* (× *P. pseudo-Zizii*) Hagstr., *Crit. Res. Pot.* 210 (1916). *P. gramineus* × *lucens* (× *P. Zizii*) Hagstr., *Crit. Res. Pot.* 210 (1916). × *P. Zizii* forma *pulcherrimus* Hagstr., *Crit. Res. Pot.* 214 (1916). *P. angustifolius* of Am. auth., in part; not Bercht. & Presl, *Rostlin* 2: *Alismac.* 19 (1821). *P. Zizii* of Am. auth., in part; not M. & K. in Röhling, *Deutschl. Fl.* 1: 845 (1823); nor Koch ex Roth, *Enum. Plant. Germ.* 1: 531 (1827).

Of the numerous collections, the following may be mentioned: VERMONT: Lake Champlain, Alburgh, Aug. 22, 1885, *Morong* (NY, isotype of × *P. Zizii* forma *pulcherrimus*); Windmill Point Reef, Alburgh, Grand Isle Co., *Muenschner, Manning & Maguire* 73 (F); Lake Bomoseen, Castleton, Oct. 1, 1898, *W. W. Eggleston* (US). MASSACHUSETTS: Medford, herb. Tuckerman (NY, type of *P. gramineus* var. *spathulaeformis*, G, isotype); Mystic P., Medford, Oct. 8 & Sept. 24, 1865, some sheets without date, *Robbins* (G, MSC, NY, cotype material of *P. gramineus* var. *spathulaeformis*); also July 10, 1879 (G), July 25, 1879 (G, NY), Aug. 5, 1879 (NY), Aug. 11, 1879 (F, NY), Sept. 1, 1879 (NY), Sept. 15, 1879 (F, NY), Aug. 5, 1881 (MSC, NY), July–September (C), all by *Morong*; also July 27, 1880, *E. & C. E. Faxon*

(G, US); Fresh P., Cambridge, Sept. 5, 1853, Sept. 27 and Oct. 24, 1865, herb. *Wm. Boott* (G); also Sept. 21, 1867, *Robbins* (NY); also Aug. 1876 (F), July 25, 1879 (F, NY), Aug. 2, 1879 (US), July 13, 1880 (MSC) and Sept. 14, 1886 (NY), *Morong*; also Sept. 17, 1880, *C. E. Faxon* (G); Pleasant P., Wenham, Sept. 13, 1880, *E. & C. E. Faxon* (C, F, G, NY, US); also Sept. 9, 1881, *Morong* (NY); also *E. C. & E. B. Ogden, 1762* (O). CONNECTICUT: Lake Saltonstall, Sept. 22 & 23, 1880, *E. Faxon* (G, US). NEW YORK: Cossayuna L., Washington Co., *Muenschner & Lindsey 2786* (F, G); Perch L., Jefferson Co., *Muenschner & Maguire 1684* (G); Lake Champlain, s. of Fort Ticonderoga, Essex Co., *Muenschner, Manning & Maguire 75* (F); Junius, near Geneva, *Baxter 5399* (US); Phillips P., Junius, Seneca Co., *Eames & MacDaniels 3463* (G); Pine Plains, *L. H. Hoysradt* (G). ONTARIO: McKay's L., near Ottawa, *Malte 118258* (G, V); cove above Grass Creek Island, 7 miles below Kingston, Frontenac Co., *Pennell 16333* (NY). MICHIGAN: Crystal Falls, Iron Co., *Metcalf 2253* (US) & *2256* (G, US); Pine L., Ingham Co., 1893, *C. F. Wheeler* (C, mixed with *P. illinoensis*); Cassidy L., near Chelsea, Washtenaw Co., *Hermann 9294* (NY). INDIANA: Grassy Creek, near Tippecanoe L., *Scovell 37* (US); bed of inlet to Gage L., Steuben Co., June 17, 1903, *C. C. Deam* (NY); e. side of Lake James and w. side of Pokagon State Park, Steuben Co., *Deam 56537* (G); Fletcher L., near Fulton, Fulton Co., *Deam 56524* (G); Lake Maxinkuckee, *Evermann 544a* (US). WISCONSIN: Green Bay near Suamico's shore, July 11, 1886, *J. H. Schuette* (G); n. side of Puckaway L., Green Lake Co., *Uhler & McLaughlin 375* (F, G) & *1091* (US). MINNESOTA: Green L., Chisago Co., July 1892, *B. C. Taylor* (NY); Pelican L., Koochiching Co., *Metcalf 1532* (G, US); Deep L., Cass Co., *Metcalf 2373* (US); Snail L., Ramsey Co., *Oosting 28164* (NY). IOWA: Armstrongs Grove, Aug. 1881, *R. I. Cratty* (NY). NEBRASKA: West Chain L., *Thomson 73b* (US); Dewey L., *Tolstead 616* (G). IDAHO: Priest L., *MacDougal 304* (C, NY); also *Piper 3761* (G, NY, US); Pend Oreille L., Bonner Co., *Muenschner 10208* (G, O) & *10212* (O). ARIZONA: Montezuma Well, *Jackson 52* (US); also *Taylor 78* (US).

P. GRAMINEUS × RICHARDSONII

P. nitens sensu Benn., Journ. Bot. **39**: 200 (1901), in part; also Journ. Bot. **65**: 115 (1927), in part. *P. epihydrium* × *angustifolius* Benn., Journ. Bot. **42**: 71 (1904). *P. Claytonii* × *Zizii* Graebn. in Engler, Pflanzenr. **4**: fam. 11: 133 (1907). × *P. subdentatus* β *petiolatus* Hagstr., Crit. Res. Pot. 201 (1916). *P. Hagströmii* Benn., Trans. & Proc. Bot. Soc. Edinburgh **29**: 51 (1924).

The following appear to be this hybrid: ONTARIO: Lake Nipissing, *Chitty 265* (G). MICHIGAN: St. Mary's R., Sault Ste. Marie,

E. J. Hill 133.1881 (C); northwest end of Brevort L., Moran, Mackinac Co., *Ogden & Bolan* 1681 (G, O); Detroit R., Oct. 4, 1892, *Farwell* 473a (G); also Aug. 25, 1892, *Farwell* (G); also Oct. 4, 1892, *Farwell* (NY). ILLINOIS: Wolf L., Chicago, *Agnes Chase* 1713 (F); also June 10, 1911, *Earl E. Sherff* (F). ALBERTA: Indian Graveyard, Peace R., Wood Buffalo Park, *Raup* 1547 (C, G, NY). COLORADO: Carleton L., near Grand L., *Shear & Bessey* 5333 (NY). BRITISH COLUMBIA: Griffin L., *Macoun* 4179 (C, G, isotypes of \times *P. subdentatus* β *petiolatus*); Sumas L., *J. M. Macoun* 26816 (C, type of *P. Hagströmmii*, G, NY, isotypes).

P. GRAMINEUS \times PERFOLIATUS VAR. BUPLEUROIDES

? *P. nitens* sensu Morong, Mem. Torr. Club 3: no. 2: 34 (1893). *P. gramineus* var. *spathulaeformis* sensu Fern., RHODORA 23: 190 (1921) and RHODORA 35: 131 (1933); not Robbins in Gray, Man. 5: 487 (1867). \times *P. nitens* var. *subgramineus* f. *restrictus* Hagstr., Crit. Res. Pot. 223 (1916). \times *P. subnitens* Hagstr., Crit. Res. Pot. 259 (1916).

The following are referred here: NEWFOUNDLAND: Highlands Brook above bridge, Crabbes, *Kennedy* 78 (G); Otter P., Brig Bay, *Fernald*, *Wiegand*, *Long*, *Gilbert & Hotchkiss* 27341 (F, G, probably backcrossed with *P. gramineus*); also 27342 (G, probably backcrossed with *P. gramineus*). QUEBEC: Matane R., Matane, Matane Co., Aug. 5, 1904, *Forbes* 156 (C, G, one sheet of this collection in G is rather typical *P. perfoliatus* var. *bupleuroides*); Rivière Ouest, Gaspé Co., *Victorin*, *Rolland & Jacques* 44459 (G, MT); Ile du Large, Iles de Boucherville, St. Lawrence R., *Victorin & Rolland* 44738 (F, G); Berthier-en-bas, St. Lawrence R., *Rousseau* 20444 (G); also 20445 (G, US, V); Ile Plate, St. Lawrence R., Longueuil, Chambly Co., *Victorin* 8176 (G); also 28604 (C, G); also *Rolland* 43361 (C, F, G); Ile Verte, St. Lawrence R., Longueuil, Chambly Co., *Rolland* 43367 (G); also 43368 (F); also 43376 (G); also 43378 (G); also 43382 (F, G); Lac Aylmer, Wolfe Co., *Louis-Marie*, *Laporte & Dudemaine* 301 (G). ANTICOSTI: Becscie R., *Macoun* 2983 (C); Salt L., *Macoun* 2986 (C). NEW BRUNSWICK: St. John R., Ingleside, Westfield, *Fernald* 1609 (G); Hammond R., Hammond, Kings Co., *Svenson & Fassett* 3025 (G); Jacques R., Restigouche Co., *Svenson & Fassett* 3030 (G); St. John R., Lincoln, Sunbury Co., *Fassett* 2151 (G); Fredericton, July 30, 1892, *J. Fowler* (US); Campbellton, Aug. 26, 1905, *J. Fowler* (US). NOVA SCOTIA: "plaster hole lake" near Dingwall, Cape Breton Island, *Nichols* 1037 (G); Shinimikas R., Northport, Cumberland Co., *Fassett* 2150 (G); Midway (Centreville) L., Centreville, Digby Co., *Graves & Linder* 19691 (G, perhaps backcrossed with *P. gramineus*). MAINE: St. John R., Madawaska, Aroostook Co., July 28, 1893, *Fernald* (G, NE, NY); Pushaw P., Oldtown, Aug. 21,

1899, *L. H. Harvey* (US); Pushaw P., Glenburn, Penobscot Co., *Ogden & Steinmetz 1544* $\frac{1}{2}$ (G, O); Pushaw P., Hudson, Penobscot Co., *Ogden & Steinmetz 2195* (ME, O); Mattagodus Stream, Prentiss, Penobscot Co., *Steinmetz 320* (G, ME, O, possibly *P. alpinus* \times *gramineus*); also *Ogden & Wright 2342* (ME, O, possibly *P. alpinus* \times *gramineus*). NEW HAMPSHIRE: Connecticut R., Walpole, *Fernald 440* (G); mouth of brook, Melvin, *Sargent 31* (G). VERMONT: Winooski R., Essex Junction, *Blake 2216* (US); Connecticut R., Brattleboro, 1865, *C. C. Frost* (G). MASSACHUSETTS: Wenham P., Sept. 13, 1880, *Edwin Faxon* (C, G, NY, US, see next citation); also Sept. 5, 1882, *Edwin Faxon* (G, NY, type collection of \times *P. subnitens*; some of the Wenham Pond collections appear to be this hybrid, probably backcrossed with *P. perfoliatus* var. *bupleuroides*; some cannot be distinguished from ecological forms of *P. perfoliatus* var. *bupleuroides*). CONNECTICUT: Taunton P., Newtown, *E. H. Eames 11733* (G); Beardsley P., Danbury, *E. H. Eames 11741* (G, possibly not this hybrid). NEW YORK: Hudson R., Mechanicville, Rensselaer Co., *Muen-scher & Lindsey 2770* (G) & *2865* (G, O); Myers Pt., Cayuga L., Aug. 13, 1884, herb. *W. R. Dudley* (NY); Old Chenango Canal, near South Oxford, July 1, 1886, *F. V. Coville* (US); Chemung R. near Wellsburg, *Lucy 10843* (F); Chenango R., Brisben, June 28, 1887, *F. V. Coville* (US); slow stream, $\frac{1}{2}$ mi. s. of the Jefferson Co. line, on route No. 3, n. w. of Sandy Creek, Oswego Co., *Ogden & Bolan 1578* (G, O). NEW JERSEY: river-edge above Phillipsburg, July 23, 1886, *T. C. Porter* (NY). PENNSYLVANIA: near Easton, Sept. 8, 1868, *T. C. Porter* (F). VIRGINIA: Dyke, Fairfax Co., *Metcalf & Sperry 1684* (US). ONTARIO: Almonte, July 6 & 7, 1898, *J. Fowler* (F, G); Missinaibi R., *J. M. Macoun 2979* (C, G).

This cross is between species of relatively unrelated subsections and the progeny are extremely variable and often very odd. As with most hybrids among the broad-leaved species of *Potamogeton*, no description can be given that is both inclusive and limiting. The hybrid must be distinguished as an intermediate between the two parents. It often appears with floating leaf-blades tapering gradually into the petiole and with clasping submersed leaves having sharp-pointed apices. Mature fruit is unknown in interspecific crosses, but may occasionally appear in backcrosses. The anatomy of the stem shows a blend between the two parents, presenting all the possible combinations with a trio-type or oblong-type of stele, O-cells or U-cells in the endodermis, and cortical bundles present or absent. Next to *P. gramineus* \times *illinoensis*, this is probably the most frequent *Potamogeton*-

hybrid in North America. It is one of the easiest to recognize. The nearest approach to it is *P. gramineus* \times *Richardsonii* which can usually be distinguished by its coarser stipules.

P. GRAMINEUS \times *P. SP.*

P. angustifolius var. *methyensis* Benn., Journ. Bot. **29**: 151 (1891). *P. Zizii* var. *methyensis* Benn. in Macoun, Cat. Can. Pl. 370 (1890); Graebn. in Engler, Pflanzenr. **4**: fam. 11: 83 (1907). *P. methyensis* Benn., Trans. & Proc. Bot. Soc. Edinburgh **29**: 50 (1924).

Methye L., near Methye Portage, SASKATCHEWAN, July 18, 1888, *J. M. Macoun* 4178 (C, TYPE of *P. methyensis*).

A number of collections are hybrids with *P. gramineus* quite evidently one of the parents. Among these is the Methye Lake plant upon which *P. methyensis* is based. From the single sheet seen by me I cannot determine the other parent. *P. illinoensis* might seem a good guess, but it is not reported so far north. *P. alpinus* and *P. Richardsonii* abound in the region, but I am unable to see marked influence of either of these species. Hagström may not have seen this collection; at least he mentions the name only in the index to his Critical Researches. He is, however, referring to it (among others) when he says, “. . . but many *Zizii*-like North American plants are not at all this hybrid, but of another origin, and great carefulness is necessary when considering these difficult forms.”¹

P. ILLINOENSIS \times *RICHARDSONII*

INDIANA: Bass L., Starke Co., Aug. 7, *W. S. Blatchley* (Deam).

P. ILLINOENSIS \times *PERFOLIATUS* var. *BUPLEUROIDES*

? \times *P. subdentatus* α *sessilis* Hagstr., Crit. Res. Pot. 201 (1916); not \times *P. subdentatus* β *petiolatus* Hagstr., *ibid.*

NEW YORK: Sodus Bay, *Killip* 12264 (G, US); Onondaga L., Aug. 1, 1890, *L. M. Underwood* (NY). FLORIDA: Apalachicola, herb. *Chapman* (G, NY, US); mouth of Choctawhatchee R., June 18, 1880, *C. Mohr* (US). ALABAMA: estuary of Mobile R., July 22, 1884, *C. Mohr* (US).

Hagström cites a specimen from Queenston, ONTARIO (without mentioning collector's name and date), which he considers to be *P. illinoensis* \times *perfoliatus*. I have not seen this collection.

¹ Hagström, Crit. Res. Pot. 216 (1916).

The collection from Griffin L., BRITISH COLUMBIA, which he also cites as having these parents, is *P. gramineus* \times *Richardsonii*.

P. ILLINOENSIS \times *P. SP.*

" . . . a peculiar form of *P. natans*," Morong, Bull. Torr. Bot. Club 13: 145 (1886). *P. floridanus* Small, Fl. Se. U. S. 37 and 1326 (1903); Benn., Journ. Bot. 45: 376 (1907); Graebn. in Engler, Pflanzenr. 4: fam. 11: 62 (1907). ? *P. Tepperi* Benn., Journ. Bot. 45: 373 (1907); Graebn. in Engler, Pflanzenr. 4: fam. 11: 62 (1907). ". . . apparently an immature form. . ." of *P. natans*, Taylor, N. Am. Fl. 17: pt. 1: 16 (1909). "probably belonging to the group *Amplifolii*," Hagstr., Crit. Res. Pot. 268 (1916).

FLORIDA: Blackwater R., May 1886, A. H. Curtiss (NY, TYPE and isotype of *P. floridanus*); also June 22, 1886, Curtiss (NY).

Further collections and perhaps a study of the living plants will be needed to determine the exact nature of this plant. It is possible that it is a cross between *P. illinoensis* and a linear-leaved species. The stem-anatomy is: stele with the proto-type pattern, endodermis of U-cells, interlacunar bundles weakly developed and only in the outer interlacunar circle, subepidermal bundles absent or weakly developed, pseudo-hypodermis present or absent. Curtiss collected in the same river, and by the dates on the sheets presumably at the same time, fragmentary bits of *P. foliosus* Raf. var. *macellus* Fern. Other linear-leaved species of *Potamogeton*, subgenus *Eupotamogeton*, found in the general region are: *P. pusillus* L. (*P. panormitanus* Biv.), *P. Berchtoldi* Fieber (*P. pusillus* of auth., not L.), *P. diversifolius* Raf., and *P. capillaceus* Poir. None of these linear-leaved species has interlacunar bundles and all have O-cells in the endodermis, so if one is a parent, the other parent must possess interlacunar bundles and a U-celled endodermis. The only broad-leaved species agreeing with this would be *P. illinoensis*. The stelar pattern of the plant in question leads me to consider *P. pulcher* as a possible parent, though it lacks interlacunar bundles and has an O-celled endodermis. In such case, the only linear-leaved species that can be considered to be the other parent is *P. pectinatus*, in the subgenus *Coleogeton*; it being the only linear-leaved species in the region with interlacunar bundles and with U-cells in the endodermis. It is possible that the plant is a pronounced eco-

logical form of *P. Oakesianus* or *P. natans*, neither of which has been otherwise found within 600 miles of Florida.

P. PRAELONGUS × *RICHARDSONII*

MICHIGAN: Saulte Ste. Marie, Aug. 4, 1881, *E. J. Hill* (US).
UTAH: Fish L., Sevier Co., *Tanner 5786* (F).

P. PERFOLIATUS var. *BUPLEUROIDES* × *RICHARDSONII*

It is reasonable to suppose that the two closely related species, *P. Richardsonii* and *P. perfoliatus*, would hybridize rather freely where their ranges overlap. Such appears to be the case, for these species remain quite recognizable (though exhibiting much ecological variation) throughout their separate ranges, but where these ranges overlap, all intergradations occur. One might consider the entities that bridge the narrow gap to be those from which the two species have evolved were it not that such plants are always sterile and often exhibit other evidences of hybridism. Such plants occur in Quebec, northern Maine, New Hampshire, and are especially abundant in New York. They occasionally occur elsewhere. Although the evidence is strongly in favor of numerous hybrids between *P. Richardsonii* and *P. perfoliatus* var. *bupleuroides*, it is practically impossible to be sure of this with individual collections, for ecological or other conditions of growth might cause a simulation of this in either of these closely related species. For this reason, no collections are cited.

P. BERCHTOLDI × *PERFOLIATUS* var. *BUPLEUROIDES*

RHIZOME extensively creeping. STEM terete .4-.7 mm. in diameter, usually branched; stele with the oblong-type pattern (sometimes with the 1-bundled-type pattern), endodermis of non-stratified O-cells; interlacunar and subepidermal bundles absent, or with a few weakly developed subepidermal ones; pseudo-hypodermis 1 cell thick. LEAVES all submersed, delicate, oblong to oblong-linear, .5-4 cm. long, .2-.6 cm. wide; nerves 3-7; sessile and cuneate at base, semi-clasping; apex obtuse or acutish, but not sharp-pointed; margin entire (with 1-celled denticles on the Nantucket specimen); lacunae of 1 or 2 rows of cells each side of the midrib, commonly with a pair of glands at the base. STIPULES delicate, more or less persistent, ovate-oblong, rounded at apex, .3-1.5 cm. long, without keels. PEDUNCLES about same thickness as stem, sometimes slightly incrassate, 1-4 cm. long. SPIKES with 1-4 whorls, not crowded at anthesis; in flower .2-.5

cm. long, .2-.3 cm. thick. FLOWERS sessile; sepaloid connectives greenish, blades orbicular or elliptical, 1-1.8 mm. wide, claws .6-.8 mm. long; anthers .7-1 mm. long. Mature FRUITS unknown. Immature fruits obovate, about .9 mm. long (excluding beak) and .8 mm. wide; beak prominent, about .5 mm. long, curved toward the back; keels none; exocarp greenish; seed aborted, apex pointing toward basal end. WINTER BUDS abundantly produced late in the season, mostly near the rhizome, with leaves appressed to the shortened axis, or tightly appressed for about half their length and with the upper halves strongly divergent; basal glands prominent and forming adventitious roots.

P. mysticus Morong, Bot. Gaz. 5: 50 (1880); Mem. Torr. Club 3: no. 2: 34 (1893); Graebn. in Engler, Pflanzenr. 4: fam. 11: 95 (1907); Robinson & Fern. in Gray, Man. ed. 7: 75 (1908), with suggestion that it is "probably a hybrid" of *P. bupleuroides* (*perfoliatus* var. *bupleuroides*) and *P. pusillus* (*Berchtoldi*); Taylor, N. Am. Fl. 17: pt. 1: 22 (1909), "apparently a depauperate form" of *P. perfoliatus*, and "may be a hybrid"; Britton in Britt. & Brown, Ill. Fl. 1: 80 (1913) "apparently a depauperate form" of *P. perfoliatus* and "Perhaps a hybrid." *P. bupleuroides* × *pusillus* (× *P. mysticus*) Hagstr., Crit. Res. Pot. 259 (1916).

In brackish water, Maine, Massachusetts, and Maryland. The following are referred here: MAINE: Dunston Marshes, Scarboro, Sept. 20, 1920, A. H. Norton; Stuart Brook, West Scarboro, Scarboro, Cumberland Co., Steinmetz & Marston 539, *Plantae Exsiccatae Grayanae* 905; also Steinmetz 617; also Ogden, Rollins & Wiggins 1731; Lily P., Fortune Rocks, Biddeford, Sept. 3, 1899, G. G. Kennedy. MASSACHUSETTS: Mystic P., Aug. 13 and Sept. 3, 1865, Wm. Boott; Mystic P., Medford, on several dates in 1879, 1880, and 1881 by Morong and the Faxons; Miacomet P., Nantucket, July 13, 1887, Morong. MARYLAND: near Ocean City, H. L. Clark 6.

This interesting hybrid was evidently first collected by Wm. Boott in Mystic Pond (now called Mystic Lakes) in 1865. In 1879 Morong found the plant still there, and in 1893 wrote, "Since I obtained this . . . in 1879, I have visited the locality for several years in succession, and, though I have always found the plant growing vigorously, yet it has shown no signs of prefecting [sic] fruit."¹ In the summers of 1935, '36 and '37 I searched the Mystic Lakes carefully for it without success. The town of Medford extends only into the lower lake where *P. perfoliatus* var. *bupleuroides* now abounds. In this lower lake no

¹ Morong, Mem. Torr. Club. 3: no. 2: 35 (1893).

P. Berchtoldi was seen, but there is in the middle lake, now separated from the lower by a dam, a flourishing patch of *P. Berchtoldi* var. *tenuissimus*. This var. of *P. Berchtoldi* was found with the hybrid at Scarboro, Maine, and it appears safe to designate this variety as one of the parents of the Mystic Lakes and Scarboro plants. Whether it is this variety of *P. Berchtoldi* which is a parent of the other specimens cannot be said. A search at the Scarboro locality, where the plant thrives in abundance, failed to reveal any mature fruits, although flowering spikes were plentiful. One of the most striking characteristics of this plant in the latter part of the season is its abundance of winter buds. In its morphological characters as well as its stem-anatomy this hybrid is intermediate between the supposed parents.

EXPLANATION OF PLATES

PLATE 746. FRUITS OF POTAMOGETON (all $\times 5$)

P. ALPINUS var. *TENUIFOLIUS*: FIG. 1, Maine, *Fernald* 117; FIG. 2, Newfoundland, *Kennedy* 81; FIG. 3, Washington, *Suksdorf* 2172.

P. ALPINUS var. *SUBELLIPTICUS*: FIG. 4, Maine, Sept. 5, 1894, *Fernald*; FIG. 5, Quebec, *Fernald*, *Long* & *St. John* 6766 (TYPE); FIG. 6, New York, *House* 15182.

P. POLYGONIFOLIUS: FIGS. 7, 8, 9, Newfoundland, *Fernald* & *Wiegand* 4467.

P. AMPLIFOLIUS: FIG. 10, Ohio, *Goodrich* 209; FIGS. 11 & 12, New York, *Muenschner* & *Maguire* 723 (12 with mesocarp removed); FIG. 13, Ontario, Aug. 19, 1902, *Fowler*.

P. PULCHER: FIG. 14, Rhode Island, *Fernald*, *Long* & *Torrey* 8444; FIG. 15, Massachusetts, July 1887, *Morong*; FIGS. 16, 17, Massachusetts, June 16, 1878, *C. E. Faxon* (17 with mesocarp removed).

P. NODOSUS: FIG. 18, Minnesota, *Hotchkiss* & *Jones* 480; FIG. 19, Connecticut, 1845, *Robbins*; FIG. 20, Wisconsin, July 28, 1891; FIG. 21, District of Columbia, Sept. 25, 1897, *Steele*.

P. NATANS: FIG. 22, Ontario, *Ogden* & *Bolan* 1646; FIG. 23, Minnesota, *Grant* & *Oosting* 3203; FIGS. 24, 25, New York, *Ogden* & *Bolan* 1580 (25 with mesocarp removed).

P. OAKESIANUS: FIG. 26, Massachusetts, Aug. 28, 1851, *Robbins*; FIG. 27, Quebec, *Fernald*, *Long* & *St. John* 6765; FIG. 28, Nova Scotia, *Long* & *Linder* 19679; FIG. 29, Michigan, *Pease* & *Ogden* 25135.

P. ILLINOENSIS: FIG. 30, Iowa, July 21, 1882, *Cratty*; FIG. 31, Illinois, Sept. 1881, *Patterson* (TYPE); FIGS. 32, 33, Florida, *Curtiss* 6692; FIG. 34, Indiana, *Lansing* 1079; FIG. 35, New York, *R. Hitchcock* 11175a.

P. GRAMINEUS: FIG. 36, Washington, *J. W. Thompson* 7589; FIG. 37, Newfoundland, *Fernald* & *Long* 1210; FIG. 38, Michigan, *Metcalf* 2187.

P. PRAELONGUS: FIGS. 39, 40, New York, *Muenschner* & *Maguire* 1747.

P. RICHARDSONII: FIG. 41, Wisconsin, *Cheney* 4919; FIG. 42, New York, Aug. 21, 1886, *Morong*; FIG. 43, Quebec, *Victorin* 18462; FIG. 44, Michigan, 1863, *Robbins*; FIG. 45, Washington, Aug. 1892, *Piper*; FIG. 46, Montana, *Maguire* 497.

P. PERFOLIATUS var. *BUPLEUROIDES*: FIG. 47, Newfoundland, *Robinson* & *Schrenk* 207 (TYPE); FIG. 48, Maryland, *Coville* 118; FIG. 49, Nova Scotia, *Graves* & *Linder* 19693; FIG. 50, Quebec, *Fernald*, *Long* & *St. John* 6771 (mesocarp removed).

PLATE 747. POTAMOGETON NATANS: CROSS-SECTION OF STEM, $\times 35$.

Camera-lucida drawing (cell-contents not shown) by *Francis T. Horne* from preparation by *Edith B. Ogden*.

PLATE 748. CAMERA-LUCIDA DRAWINGS (CELL-CONTENTS NOT SHOWN) FROM STEMS OF POTAMOGETON SHOWING TYPES OF STELES.

FIG. 1, *P. AMPLIFOLIUS*, $\times 40$ (*Ogden & Marston* 1693); FIG. 2, *P. PERFOLIATUS* VAR. *BUPLEUROIDES*, $\times 75$ (*Steinmetz* 526); FIG. 3, *P. NODOSUS*, $\times 75$ (*Metcalf* 1105); FIG. 4, *P. GRAMINEUS* VAR. *MAXIMUS*, $\times 75$ (*Ogden & Steinmetz* 1552); FIG. 5, *P. GRAMINEUS* VAR. *TYPICUS*, $\times 75$ (*Ogden & Bolan* 1644); FIG. 6, *P. BERCHTOLDI* VAR. *TENUISSIMUS* \times *PERFOLIATUS* VAR. *BUPLEUROIDES* (\times *P. mysticus*), $\times 100$ (*Ogden, Rollins & Wiggins* 1731).

LIST OF NUMBERED EXSICCATAE

- Abrams, L. R.** 6094, 8677 natans, 9241 amplifolius.
Adams, J. W. 293 amplifolius, 511 Oakesianus.
Adams & Tash. 512 crispus.
Adams & Trudell. 378 amplifolius.
Adrien, F. 1316 perfoliatus v. bupleuroides, 1442 illinoensis \times nodosus, 1470, 1750 perfoliatus v. bupleuroides, 1758 Richardsonii, 1806 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii), 1809 nodosus, 1975 perfoliatus v. bupleuroides.
Alexander, C. P. 90 nodosus.
Allen, J. A. 55 pulcher, 149, 180, 181 gramineus.
Anderson, J. P. 20 gramineus approaching v. maximus, 21 natans, 838 Richardsonii, 1344 natans, 1522 Richardsonii.
Anderson, R. M. 118276 Richardsonii.
Anderson & Fassett. 19349 amplifolius.
Anderson, Smith & Weatherby 1166 natans.
Anselm, Bro. M. 18 natans, 20 gramineus v., 298 perfoliatus v. bupleuroides, 366, 376 praelongus.
Applegate, E. I. 741 gramineus approaching v. maximus, 742 natans, 3416 Richardsonii, 4489 natans.
Arsène, L. 38 pulcher, 40 perfoliatus v. bupleuroides, 41 polygonifolius, 43 perfoliatus v. bupleuroides.
Arsène & Benedict. 15429, 16636 nodosus.
Arthur, Bailey & Holway B46, B69, B403 gramineus v. maximus.
Austin, Mrs. R. M. 575, 1177 Richardsonii, 1672 natans.
Bailey, L. H. 86 natans.
Bailey, W. W. 1135 Richardsonii.
Baker, C. F. 427 illinoensis.
Ballard, C. A. 731½ gramineus approaching v. maximus.
Barkley, F. A. 1783 gramineus, 1996 gramineus v. myriophyllus, 1997 Richardsonii.
Baxter, M. S. 5382 praelongus, 5385 Richardsonii, 5388 crispus, 5389 nodosus, 5391 illinoensis, 5392 gramineus, 5395 natans, 5396 illinoensis, 5399 gramineus \times illinoensis, 5402 illinoensis, 5403 amplifolius.
Bean & White. 19675 natans, 19696 perfoliatus v. bupleuroides, 22962 gramineus v. maximus, 22963 alpinus v. tenuifolius.
Bebb, R. 994 illinoensis, 995 natans, 1007 illinoensis (perhaps gramineus \times illinoensis), 1008 natans, 1009 praelongus, 1538 illinoensis.
Beetle, A. A. 1462 Richardsonii, 2341 gramineus.
Bell, R. 2968 amplifolius.
Benson, L. 2824 natans, 4013 gramineus.
Bergman, H. F. 443 gramineus, 2484 amplifolius.
Berkley, E. E. 1215 crispus, 1387 amplifolius.
Bessey, E. A. B & D2781 alpinus v. tenuifolius.
Bicknell, E. P. 91 gramineus, 92 illinoensis, 112 Oakesianus, 118 perfoliatus v. bupleuroides, 122 praelongus.
Biltmore Herbarium. 688 Richardsonii, 4413a illinoensis, 5806a

- nodosus, 5980a pulcher, 8806b nodosus.
Bissell, C. H. 633 natans.
Bissell & Linder. 19678 natans, 19692 gramineus, 19695 perfoliatus v. *bupleuroides*.
Blake, S. F. 2212 perfoliatus v. *bupleuroides*, 2216 gramineus \times perfoliatus v. *bupleuroides*, 2308 Richardsonii, 3071 gramineus, 5483 perfoliatus v. *bupleuroides*, 9472 crispus.
Blackley, O. W. 1453 pulcher.
Blewitt, A. E. 632 amplifolius, 1677 perfoliatus v. *bupleuroides*, 1977 gramineus, 1978 perfoliatus v. *bupleuroides*, 2137 Richardsonii, 3651 perfoliatus v. *bupleuroides*, 3652 gramineus, 3657 nodosus, 4319, 4320 perfoliatus v. *bupleuroides*.
Bodin, J. E. 264 illinoensis.
Boettcher, F. L. J. 9 pulcher.
Boivin & Blain. 294 alpinus v. tenuifolius, 670 perfoliatus v. *bupleuroides*, 1344 alpinus v. tenuifolius approaching v. subellipticus, 2139 alpinus v. tenuifolius, 2446 alpinus v. subellipticus.
Bolander. 274 illinoensis.
Bowman, P. W. 303 gramineus, 392 Oakesianus.
Breed, Jeffrey, Jenkins, Loveless, Phillips, Stauffer & Stebbins 20 Richardsonii.
Brewer, W. H. 1783 gramineus, 1978 alpinus v. tenuifolius.
Bridges, T. 359 natans.
Brien, C. 306 nodosus.
Brinkman, A. H. 734 Richardsonii, 2277, 2289, gramineus, 4541 alpinus v. tenuifolius.
Brittain. 2987 gramineus v. maximus.
Brown, H. E. 644 natans.
Brown, S. 694 Richardsonii.
Burgess. 3029 natans.
Burkholder & Muenscher. 16404 amplifolius, 16424, 16425 Richardsonii.
Burkholder & Tressler. 16888 Richardsonii.
Burnham, S. H. 42 illinoensis.
Bush, B. F. 89 pulcher, 112 amplifolius, 1207 nodosus, 1318 amplifolius, 6947 illinoensis.
Butler, B. T. 251 gramineus, 255 Richardsonii, 257, 296 gramineus.
Butler, G. D. 142 Richardsonii.
Cain, R. F. 935 nodosus, 938 gramineus, 940 Richardsonii, 941 amplifolius, 972 praelongus, 978 illinoensis, 1030, 1031 amplifolius, 1043 gramineus v. maximus (perhaps gramineus \times sp.), 1045 natans, 1049 Richardsonii, 1050 praelongus, 1051, 1052 Richardsonii.
Camp, S. H. 13 praelongus.
Carter, W. R. 337 gramineus v., 505 gramineus.
Chamberlain, E. B. 412 amplifolius, 616 perfoliatus v. *bupleuroides*, 617 natans, 913 perfoliatus v. *bupleuroides*, 943 natans, 1033 perfoliatus v. *bupleuroides*.
Chamberlain, G. D. 1750, 1770 gramineus, 2011 alpinus v. tenuifolius, 2123 perfoliatus v. *bupleuroides*, 2159 gramineus, 2240 praelongus, 2276 praelongus.
Chamberlain & Collins. 616 perfoliatus v. *bupleuroides*.
Chamberlain & Knowlton. 571 perfoliatus v. *bupleuroides*.
Chamberlain & Morris. 11741 Oakesianus.
Chase, Agnes. 1420 nodosus, 1421 Richardsonii, 1459 natans, 1466 praelongus, 1477 nodosus \times Richardsonii, 1707 gramineus, 1710 amplifolius, 1713 gramineus \times Richardsonii, 1994 nodosus \times Richardsonii.
Cheney, L. S. 499 praelongus, 683 gramineus v. maximus, 866 Richardsonii, 1086 nodosus, 1420 natans, 1501 alpinus v. tenuifolius, 1735 amplifolius, 2097, 3576 Richardsonii, 3610 Oakesianus, 4919 Richardsonii, 4921 illinoensis.
Chitty, D. H. 204 gramineus, 260 natans, 261 gramineus, 265 gramineus \times Richardsonii, 268, 269 gramineus (perhaps gramineus \times perfoliatus v. *bupleuroides*), 306 Richardsonii, 319 amplifolius, 328 gramineus.
Clark, D. 2008 Richardsonii.
Clark, H. L. 6 Berchtoldi \times perfoliatus v. *bupleuroides*.
Clark, H. W. 5 amplifolius, 6 illinoensis, 10 amplifolius.
Clements, F. 305, 2627 nodosus, 2979 amplifolius.
Clements, F. E. & E. S. 491 alpinus v. tenuifolius.
Cléonique. 7231 amplifolius.

- Clinton, G. W.** 5 gramineus v. maximus.
- Clokey, I. W.** 3118 alpinus v. tenuifolius.
- Collins, F. S.** 300 Oakesianus, 421 perfoliatus v. bupleuroides, 937 natans.
- Collins, Fernald & Pease.** 4013½, 5200, 5200A, 5287 gramineus, 5295 natans, 5314 gramineus, 5510 gramineus v., 5578 perfoliatus v. bupleuroides, 5911 alpinus v. subellipticus, 6050 alpinus v. subellipticus, 6125 gramineus.
- Conard, H. S.** 182 natans, 318 Richardsonii.
- Cooper, W. S.** 69 gramineus, 93 amplifolius, 94 gramineus v., 215 amplifolius, "254 in pt." alpinus v. tenuifolius, 260 natans, 312 praelongus.
- Cooper & Andrews.** 14 gramineus.
- Copeland, E. B.** 406 gramineus approaching v. maximus.
- Copeland.** 3482 gramineus approaching v. myriophyllus.
- Corbett & Williams.** 11 Richardsonii.
- Cory, V. L.** 8502 illinoensis, 9198 nodosus, 20906, 23819 illinoensis, 24332 nodosus, 24335, 27999 illinoensis, 29711 nodosus.
- Cotton, J. S.** 809 Richardsonii.
- Coville, F. V.** 114, 118 perfoliatus v. bupleuroides, 129, 189 amplifolius, 602 gramineus, 1254 praelongus.
- Coville & Applegate.** 44 gramineus approaching v. myriophyllus.
- Coville & Funston.** 1244, 1278 nodosus, 1693 gramineus.
- Coville & Kearney.** 385 gramineus, 1564 alpinus v. tenuifolius.
- Coville & Leiberger.** 224, 228 natans.
- Cowles, H. C.** 1405 natans.
- Crandall, C. S.** 2530 nodosus.
- Crickmay, C. H.** 5 Richardsonii.
- Curtiss, A. H.** 4, 6692 illinoensis.
- Cushman, J. A.** 1766 natans, 6007 nodosus, 6009 Richardsonii, 6010 gramineus, 6825 gramineus v. maximus.
- Cusick, W. C.** 2484 praelongus, 2597 natans, 3620 Richardsonii.
- Daniels, F.** 683 nodosus.
- Darlington, H. T.** 1311 illinoensis, 1323, B & D2401, B & D2692 Richardsonii.
- Davis, R. J.** 378-W praelongus.
- Dawson, G. M.** 3046 Richardsonii.
- Deam, C. C.** 25704 pulcher, 31302 gramineus × illinoensis, 31591 gramineus, 38978 nodosus, 48466 amplifolius, 49019 natans, 49042 illinoensis, 49205 gramineus × illinoensis, 49248 illinoensis, 49268 natans, 49274, 49285, 49312 illinoensis, 49314 amplifolius, 49315 gramineus × illinoensis, 49347, 49355 illinoensis, 49360 natans, 49363, 49369, 49372, 49389 illinoensis, 49391 natans, 49394 praelongus, 49395 illinoensis, 49399 amplifolius, 49402, 49417 illinoensis, 52273 amplifolius, 52334 natans, 52341 illinoensis, 52385 nodosus, 52425 amplifolius, 52437 natans, 54236, 54462 illinoensis, 55176 nodosus, 55313 amplifolius, 55350, 55410 illinoensis, 56274A Richardsonii, 56396 illinoensis, 56398 praelongus, 56401, 56441, 56448 illinoensis, 56490 amplifolius, 56498, 56501 illinoensis, 56502 amplifolius, 56524 gramineus × illinoensis, 56534 amplifolius, 56537 gramineus × illinoensis, 56538, 56539 illinoensis, 56541 natans, 56545 illinoensis, 56546 natans, 56547, 56568 illinoensis, 56607 crispus, 56616 amplifolius, 56680, 56682 illinoensis, 56683 amplifolius, 56686 Richardsonii, 56687 illinoensis, 56692, 56704, 56783 nodosus, 57139 praelongus, 57149 natans, 57195 illinoensis, 57259 gramineus.
- Dean & Thomas.** 3465 Richardsonii.
- Delamare, M.** 341 perfoliatus approaching v. bupleuroides.
- Demaree, D.** 7051, 7132, 17893 nodosus.
- De Selm, A. W.** 22 gramineus v. myriophyllus, 24 amplifolius and natans.
- Dobbin, F.** 860 Richardsonii, 863 perfoliatus v. bupleuroides, 1072 Richardsonii, 1112 illinoensis, 1186 amplifolius, 1207 nodosus, 1209 illinoensis, 1327 Richardsonii, 1328, 1330 natans.
- Dodge, C. K.** 4 Richardsonii, 7 illinoensis, 8 gramineus, 115 natans, 122 Richardsonii, 131 gramineus, 133 illinoensis and Richardsonii, 146 Richardsonii, 147 gramineus,

- 153 gramineus v. maximus and gramineus approaching v. maximus, 154 perhaps gramineus \times illinoensis, 155 gramineus v. maximus, 156 natans, 171 illinoensis, 172 amplifolius, 384 gramineus, 1037, 1038 Richardsonii.
- Doutt, M. T.** 2145, 2258 Richardsonii, 2490 praelongus, 3296 alpinus v. tenuifolius, 3323 Richardsonii.
- Dowell & Painter** 5385 nodosus.
- Driggs, A. W.** 40 nodosus.
- Drouet, F.** 3028 nodosus.
- Drouet & Richards.** 3309 gramineus.
- Drummond, T.** 250 nodosus, 272 illinoensis.
- Drushel, J. H.** 6069 perfoliatus v. bupleuroides.
- Dubois, A.** 660 perfoliatus v. bupleuroides.
- Dudley, W. R.** 18, 19 natans, 20 illinoensis, 2030 natans, 2201 alpinus v. tenuifolius, 2202 natans.
- Eames, A. J.** 1498 gramineus, 1500 gramineus \times perfoliatus v. bupleuroides, 3460 nodosus, 3467 crispus, 9099 gramineus.
- Eames, E. H.** 8707 illinoensis, 8746 pulcher, 9590 praelongus \times sp., 11351 illinoensis, 11485, 11502 crispus, 11733 gramineus \times perfoliatus v. bupleuroides, 11741 perhaps gramineus \times perfoliatus v. bupleuroides, 11742 illinoensis, 11745 gramineus v. maximus, 11749, 11750 illinoensis, 11856 crispus.
- Eames & Gershoy.** 9101 Richardsonii.
- Eames & Godfrey.** 8685 praelongus, 9334 alpinus v. subellipticus.
- Eames & MacDaniels.** 3463 gramineus \times illinoensis.
- Eames, Randolph & Wiegand.** 11175 illinoensis, 11181 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii).
- Eames & Thomas.** 3459 nodosus.
- Eames & Wiegand.** 9100 Richardsonii, 9102 perfoliatus v. bupleuroides, 11162 natans, 11172 amplifolius, 11173 gramineus, 11179 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii), 14535 crispus.
- Eaton, A. A.** 335 illinoensis.
- Edwards & Clausen.** 1400 perfoliatus v. bupleuroides.
- Eggleston, W. W.** 1 nodosus, 1655 amplifolius, 1656 alpinus v. subellipticus, 2111 Oakesianus, 9974 Richardsonii.
- Ehlers, J. H.** 533, 1756, 7957 praelongus.
- Elmer, A. D. E.** 2798 amplifolius.
- Emig, W. H.** 224 nodosus.
- Empain, Rousseau & Noreau.** 50925 Richardsonii.
- Evans, W. H.** 780 gramineus v. maximus, 781 natans.
- Evermann, B. W.** 490 perhaps illinoensis \times nodosus, 492 Richardsonii, 493 amplifolius, 544a perhaps gramineus \times illinoensis, 1032 natans, 1057 Richardsonii, 1079 illinoensis, 1221 gramineus, 1222 illinoensis, 1223 amplifolius.
- Eyerdam, W. J.** 1122 praelongus, 1143 gramineus, 1316 gramineus \times sp., 2141 alpinus v. tenuifolius, 2156 Richardsonii, 2360 alpinus v. tenuifolius.
- Farwell, O. A.** 473 gramineus, 473a gramineus \times Richardsonii, 505 natans, 514 alpinus v. subellipticus, 900 illinoensis.
- Fassett, N. C.** 8 gramineus v., 85, 456 perfoliatus v. bupleuroides, 468 amplifolius, 2148 perfoliatus v. bupleuroides, 2150, 2151 gramineus \times perfoliatus v. bupleuroides, 2152 perfoliatus v. bupleuroides (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 62 & 127), 3148, 4350 nodosus, 5343 alpinus v. tenuifolius, 5362 amplifolius, 7535 Richardsonii, 9014 praelongus, 9061 Richardsonii, 9067, 9069 gramineus, 14262 gramineus, v. myriophyllus, 14746 crispus, 18731 illinoensis, 18803 Oakesianus.
- Fassett & Wilson.** 4349 nodosus.
- Fellows, D. W.** 2006 amplifolius, 2007 Richardsonii, 2966, 4679 perfoliatus v. bupleuroides, 4887 Richardsonii, 5656 gramineus \times sp.
- Fendler, A.** 132 amplifolius, 837, 839 nodosus.
- Fernald, M. L.** 116 gramineus approaching v. maximus, 117 alpinus v. tenuifolius, 436 gramineus v. maximus, 440 gramineus \times perfoliatus v. bupleuroides, 475 natans, 477 gramineus v. maximus,

- 509 Oakesianus, 750 pulcher, 778 natans, 1609 gramineus \times perfoliatus v. bupleuroides, 1610, 1611, 1612 perfoliatus v. bupleuroides, 1614 amplifolius, 1619 gramineus, 1622 alpinus v. tenuifolius, 2756 natans, 2767 gramineus v. maximus, 8439, 15965 Oakesianus.
- Fernald & Abbe.** 2506 amplifolius.
- Fernald, Bartram & Long.** 23129 natans, 23131 Oakesianus, 23141 gramineus v. maximus.
- Fernald, Bartram, Long & Fassett.** 23139 amplifolius.
- Fernald, Bartram, Long & St. John.** 6764 Oakesianus, 6769 perfoliatus v. bupleuroides.
- Fernald, Bissell, Graves, Long & Linder.** 19689 amplifolius.
- Fernald & Collins.** 327 alpinus v. subellipticus, 965 alpinus v. tenuifolius.
- Fernald, Dodge & Smith.** 25421 perfoliatus, 25422, 25423, 25424 praelongus.
- Fernald & Fogg.** 505, 747 Oakesianus.
- Fernald, Gilbert & Hotchkiss.** 27346 praelongus.
- Fernald & Griscom.** 4295 pulcher.
- Fernald, Griscom & Long.** 4535 pulcher.
- Fernald, Hunnewell & Long.** 8443 pulcher, 8445 perfoliatus v. bupleuroides.
- Fernald & Jackson.** 11986 natans, 11987 alpinus v. tenuifolius, 11988 gramineus, 11989 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii).
- Fernald & Linder.** 19682 Oakesianus.
- Fernald & Long.** 1210 gramineus, 5977 pulcher, 7747 crispus, 8440, 8441 Oakesianus, 8442, 8538 pulcher, 9799 crispus, 10089 pulcher, 10873 perfoliatus v. bupleuroides, 12229 pulcher, 12230 epiphydus v. Nuttallii \times pulcher, 12381 natans, 12386 alpinus v. tenuifolius, 12387 alpinus v. subellipticus, 12388 alpinus v. tenuifolius, 12389 nodosus, 12391, 12392 perfoliatus v. bupleuroides, 13216 pulcher, 15967 perfoliatus v. bupleuroides, 17805 Oakesianus, 17807 perfoliatus v. bupleuroides, 19677 natans, 19687 alpinus v. subellipticus, 19688 amplifolius, 19690 gramineus, 19694 perfoliatus v. bupleuroides, 23130 natans, 23132 Oakesianus, 23137, 23138 pulcher, 23140 amplifolius, 23142 gramineus approaching v. maximus, 23143 perfoliatus v. bupleuroides, 27344 gramineus v., 27345 gramineus, 27347 praelongus.
- Fernald, Long & Dunbar.** 26217 Oakesianus, 26218 polygonifolius, 26221 alpinus v. subellipticus, 26222 perhaps gramineus \times perfoliatus v. bupleuroides, 26223 praelongus.
- Fernald, Long & Fogg.** 1207 alpinus v. tenuifolius, 1208 Oakesianus, 1209 gramineus v. maximus, 1211 praelongus, 1212 perfoliatus v. bupleuroides.
- Fernald, Long & Norton.** 12382 natans, 12383, 12384 Oakesianus.
- Fernald, Long & St. John.** 6763 natans, 6765 Oakesianus, 6766 alpinus v. subellipticus, 6767, 6768 praelongus, 6770, 6771 perfoliatus v. bupleuroides.
- Fernald, Long & Torrey.** 8444 pulcher.
- Fernald & Pease.** 3066 Oakesianus, 16957, 17056 gramineus, 19676 natans.
- Fernald & St. John.** 10894 natans.
- Fernald & Smith.** 25420 alpinus v. subellipticus.
- Fernald & Strong.** 477 gramineus v. maximus.
- Fernald & Svenson.** 744 gramineus v. myriophyllus, 745 natans, 748 Oakesianus, 749 praelongus, 751 perfoliatus v. bupleuroides.
- Fernald & White.** 19680 Oakesianus.
- Fernald & Wiegand.** 2435 natans, 2436 Oakesianus, 2443 alpinus v. tenuifolius approaching v. subellipticus, 2444 praelongus, 2448 gramineus, 2449 gramineus v. maximus, 2450 perfoliatus, 4466 Oakesianus, 4467, 4468 polygonifolius, 4473 alpinus v. tenuifolius, 4478, 4479 gramineus, 4483, 4484, 4485 perfoliatus v. bupleuroides, 14533 illinoensis.
- Fernald, Wiegand & Bartram.** 4463 Oakesianus.
- Fernald, Wiegand, Bartram & Darlington.** 4477 gramineus v. maximus.
- Fernald, Wiegand & Darlington.**

- 4461, 4462 natans, 4464, 4465 Oakesianus, 4474 alpinus v. tenuifolius, 4475 gramineus v. maximus, 4476 gramineus, 4480 gramineus v. maximus, 4481 gramineus, 4482 praelongus.
- Fernald, Wiegand & Eames.** 14082 alpinus v. tenuifolius, 14084, 14085 gramineus, 14086 amplifolius, 14087 Richardsonii, 14088 Richardsonii and perfoliatus v. bupleuroides, 14089 crispus.
- Fernald, Wiegand & Kittredge** 2437 Oakesianus, 2441 praelongus, 2442 alpinus v. subellipticus, 2445, 2446, 2447 gramineus, 2451 perfoliatus v. bupleuroides.
- Fernald, Wiegand & Long.** 27348 perfoliatus.
- Fernald, Wiegand, Long, Gilbert & Hotchkiss.** 27341, 27342 gramineus \times perfoliatus v. bupleuroides (probably backcrossed with gramineus)
- Ferris, Roxana S.** 2043 natans, 8845 amplifolius.
- Fiker, C. B.** 1455 natans.
- Fink, B.** 191 illinoensis.
- Fitch, A.** 7778 natans.
- Fletcher.** 2969 amplifolius, 3025, 3028 natans, 3044 Richardsonii.
- Fogg, J. M.** 710, 1840, 2077, 2997, 3505 pulcher, 3606 perfoliatus v. bupleuroides, 3867 Oakesianus, 4504 pulcher, 4934 amplifolius, 4935 praelongus, 6794 nodosus, 12254 crispus.
- Forbes, F. F.** 156 perfoliatus v. bupleuroides and gramineus \times perfoliatus v. bupleuroides.
- Foster, A. S.** 866 natans, 1992 amplifolius.
- Fredholm, A.** 6183 illinoensis.
- Fulton, H. J.** 9703 nodosus.
- Garrett, A. O.** 529 alpinus v. tenuifolius approaching v. subellipticus, 3958 nodosus.
- Gates, F. C.** 258 Richardsonii, 261 praelongus, 1752.2 natans, 10540 praelongus, 10644 illinoensis, 12217 natans.
- Gauthier, R.** 100 amplifolius, 135 perfoliatus v. bupleuroides, 2422 amplifolius.
- Gillman, H.** 40 Richardsonii (perhaps Richardsonii \times sp.), 65 Richardsonii, 67 illinoensis.
- Glatfelter, Herbarium of N. M.** 561 amplifolius, 562 Richardsonii.
- Gleason, H. A. & H. A. Jr.** 166 natans, 302, 310 gramineus.
- Gleason & Shobe.** 176 amplifolius, 179 natans.
- Glendenning, R.** 92616, 92617 gramineus, 92618 Richardsonii.
- Goldman, E. A.** 2453 natans.
- Goodale, Markert & Piper.** 76938, 76945, 76947 natans, 76948, 76951 Oakesianus, 76973 gramineus, 96988 pulcher.
- Goodding, L. N.** 539 nodosus.
- Goodman, B. B.** 16287 nodosus.
- Goodman & Hitchcock.** 1803 illinoensis (perhaps gramineus \times illinoensis).
- Goodrich, Sara F.** 207 Richardsonii, 209 amplifolius.
- Gorman, M. W.** 233, 677 Richardsonii, 703 illinoensis, 781 Richardsonii.
- Graham, E. H.** 9821 nodosus.
- Grant, M. L.** 3029 praelongus.
- Grant & Oosting.** 3184 illinoensis, 3203 natans, 3206 Richardsonii, 3207 illinoensis, 3272 gramineus, 3275 amplifolius, 3276 gramineus.
- Graves & Linder.** 19681 Oakesianus, 19691 gramineus \times perfoliatus v. bupleuroides (perhaps backcrossed with gramineus), 19693 perfoliatus v. bupleuroides.
- Griffin, D. B.** 1 illinoensis.
- Griffiths, D.** 6 Richardsonii.
- Griffiths & Schlosser.** 4 amplifolius.
- Grimes, E. J.** 594 nodosus, 3255 crispus, 4196 pulcher.
- Griscom & Mackenzie.** 10679 amplifolius, 10680 perfoliatus v. bupleuroides, 10681 praelongus, 10685 natans, 10686 gramineus.
- Hall, E.** 486 natans, 487 (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 115 & 129), 488, 488a amplifolius, 489, 490 Richardsonii.
- Hall & Chandler.** 563 alpinus v. tenuifolius.
- Hamilton.** 64010 alpinus v. tenuifolius.
- Hanes, C. R.** 327 nodosus, 367, 377, 397, 477 gramineus \times sp., 487, 497 illinoensis, 507 gramineus \times sp., 517 illinoensis, 757 amplifolius, 1928 Oakesianus and epiphydus v. Nuttallii, 1978, 1988 natans.
- Harper, F.** 74 gramineus v. maxi-

- mus (perhaps gramineus \times alpinus), 98, 141 Richardsonii.
- Harper, R. M.** 24 illinoensis (not typical), 1402, 2088 pulcher.
- Harrington, W. H.** 2441 perfoliatus v. bupleuroides, 99085 gramineus, 99086 gramineus v. maximus, 99088 perfoliatus v. bupleuroides, 99089, 99090 Richardsonii, 99091 perfoliatus v. bupleuroides, 99092 natans, 99099 perhaps gramineus \times illinoensis, 99100 perhaps alpinus \times gramineus, 99101 nodosus, 99102 gramineus v. maximus.
- Harris, S. K.** 539 praelongus, 540 perfoliatus v. bupleuroides.
- Harrison, A. K.** 15 natans, 16 illinoensis.
- Hartweg, T.** 2016 nodosus (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 66 & 130), 2017 nodosus.
- Hawkins, P. H.** 650 Richardsonii.
- Hay, G. U.** 2989 gramineus, 4131 praelongus.
- Hayden, Ada.** 751 Richardsonii, 752 nodosus, 804 Richardsonii, 806 nodosus, 807 illinoensis, 811 Richardsonii, 821 gramineus, 823 natans, 10112 nodosus, 10113 Richardsonii, 10114, 10115, 10116, 10117, 10123, 10129 nodosus.
- Haydon, W.** 254 natans.
- Heller, A. A.** 939 natans, 5824 nodosus.
- Henderson, L. F.** 1007 natans, 1009 Richardsonii, 2473 illinoensis, 2474 amplifolius, 2475 illinoensis, 2477 gramineus v., 2717 natans, 4882 nodosus.
- Hermann, F. J.** 5781 gramineus, 6281 praelongus, 7153, 7224 Richardsonii, 7230 gramineus, 8234 praelongus, 8286 gramineus, 8647 crispus, 9294 gramineus \times illinoensis, 9383, 9728 nodosus.
- Herriot, W.** 78019, 78020 gramineus.
- Hill, A. F.** 1222, 1513 Oakesianus, 2341 perfoliatus v. bupleuroides, 2560 Oakesianus, 2560a natans.
- Hill, E. J.** 46.1884 pulcher, 92.1888 alpinus v. subellipticus, 133.1881 gramineus \times Richardsonii, 151.1901, 159.1909 nodosus, 162.1900 illinoensis, 171.1900, 179.1901, 191.1902 nodosus \times Richardsonii.
- Hitchcock, A. E.** 260 gramineus, 444, 1034 nodosus.
- Hitchcock, A. S.** 1000, 1099 amplifolius, 12358 natans, 15655 nodosus.
- Hitchcock, R.** 11167, 11168 nodosus, 11175a illinoensis.
- Hodgdon, A. R.** 11 perfoliatus v. bupleuroides, 530 nodosus, 2640 natans, 2647 perfoliatus v. bupleuroides, 2652 amplifolius.
- Hodgdon & Healey.** 2977 natans.
- Hodgdon, Jones, Nolan & Harrington.** 3378 amplifolius.
- Holway, E. W. D.** 40 Richardsonii.
- Hotchkiss, N.** 75 alpinus v. tenuifolius approaching v. subellipticus, 2646 amplifolius, 2731 gramineus (perhaps gramineus \times illinoensis), 27338 alpinus v. subellipticus.
- Hotchkiss & Jones.** 417 gramineus, 480 nodosus, 3928 praelongus, 3976, 4003 Richardsonii, 4033 illinoensis, 4058 Richardsonii, 4059 gramineus, 4060 praelongus, 4083 gramineus, 4109 nodosus, 4110 natans, 4112 gramineus, 4133 illinoensis.
- Hotchkiss & Koehler.** 4179 illinoensis, 4192 amplifolius, 4193 natans, 4194 gramineus, 4222, 4223, 4226, 4227 illinoensis, 4228 praelongus, 4245 illinoensis, 4246 praelongus, 4262, 4304 illinoensis, 4307 gramineus, 4326, 4331 illinoensis, 4340 praelongus, 4349 alpinus v. subellipticus, 4353 amplifolius.
- Hotchkiss & Martin.** 4432 illinoensis, 4460 alpinus v. subellipticus.
- House, H. D.** 517 nodosus, 1329 amplifolius, 1338, 5044 natans, 6053 amplifolius, 7244 natans, 8220 Richardsonii, 8838 amplifolius, 10069 crispus, 10070 praelongus, 15182 alpinus v. subellipticus, 15193 gramineus, 16979 natans, 19852, 20002 nodosus, 21752 amplifolius, 21774, 22044 nodosus, 23174 gramineus.
- Howe & Lang.** 768 natans, 1040 gramineus.
- Howell, J. T.** 7679 Richardsonii.
- Howell, T. J.** 364 Richardsonii, 365 natans, 1496 Richardsonii, 1497 nodosus \times Richardsonii, 1498 amplifolius, 1668 gramineus.
- Hultén, E.** 7573 alpinus v. tenuifolius.

- Hylan, D. R.** 79 natans.
- Innes & Moon.** 1093 nodosus.
- Jackson, H. H. T.** 52 gramineus × illinoensis.
- Jepson, W. L.** 147 alpinus v. tenuifolius, 238 Richardsonii.
- Jesup, H. G.** 4 gramineus approaching v. myriophyllus.
- Johnson, H. N.** 2719 nodosus, 2725 perfoliatus v. bupleuroides.
- Johnston, I. M.** 6001 illinoensis.
- Jones, G. N.** 3511 illinoensis, 3889 alpinus v. tenuifolius, 5227, 7851 gramineus.
- Jones, M. E.** 734, 1297 alpinus v. tenuifolius, 1304 gramineus v. maximus, 2310 nodosus, 5788 Richardsonii, 6023 praelongus, 6606 alpinus v. tenuifolius, 9293, 9295 gramineus, 9299 Richardsonii.
- Jones, R. N.** 7465 illinoensis, 7470, 7471 crispus.
- Jones, W. W.** 432 nodosus.
- Jones & Hoffman.** 7467 Richardsonii.
- Jones & Wiegand.** 7462 illinoensis.
- Kearney, T. H.** 74 nodosus, 1626 pulcher.
- Keck, D. D.** 1188 natans.
- Keck & Stevens.** 280 illinoensis, 323 Richardsonii, 332 amplifolius, 335 crispus.
- Keck & Stilwell.** 368 natans, 373 gramineus, 377 amplifolius, 379 gramineus, 401 nodosus, 402 natans, 412 praelongus, 428, 430 crispus, 433 amplifolius, 454 gramineus, 455 praelongus, 458 Richardsonii.
- Kellogg & Harford.** 949 illinoensis.
- Kelsey & Jordan.** 8 gramineus, 9 perfoliatus.
- Kendall, Goldsborough & Doolittle.** 12 amplifolius, 17 praelongus, 22 gramineus, 111 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × Richardsonii).
- Kennedy, Rachel B.** 78 gramineus × perfoliatus v. bupleuroides, 80 natans, 81 alpinus v. tenuifolius, 82, 405 gramineus, 478 perfoliatus v. bupleuroides, 543 Oakesianus, 551 perfoliatus v. bupleuroides.
- Kenoyer, L. A.** 136 illinoensis (perhaps gramineus × illinoensis), 139 praelongus.
- Killip, E. P.** 931 amplifolius, 6203 Richardsonii, 6204 natans, 6896 pulcher, 12258 natans, 12261 amplifolius, 12264 illinoensis × perfoliatus v. bupleuroides, 12265 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii), 12266 gramineus (perhaps gramineus × illinoensis), 12487 natans and amplifolius, 12535 nodosus, 12574 Oakesianus and epihydrus v. Nuttallii, 12605 alpinus v. subellipticus and amplifolius, 12610 amplifolius, 13379 Oakesianus, 30845 pulcher.
- Kimball, R. H.** 70 Oakesianus.
- Kindle, E. M.** 93540, 93572 gramineus, 93584 natans.
- Knowlton, F. H.** 288 natans.
- Knowlton & Weatherby.** 6632 Oakesianus.
- Kreager, F. O.** 441 amplifolius.
- Krotkov, P. V.** 5142 alpinus v. tenuifolius approaching v. subellipticus and epihydrus v. Nuttallii, 5144 gramineus, 5145 gramineus v., 5147 natans, 5150 praelongus, 7027 illinoensis, 7033, 7034, 7035, 7036 gramineus, 7038 natans, 7041 Richardsonii, 8629 amplifolius, 8633 natans.
- Kubichek, W. F.** 7 natans, 13 gramineus, 17, 64 Richardsonii, 66 gramineus, 71, 72 illinoensis, 78 gramineus, 79 natans, 101 gramineus, 109 Richardsonii, 110, 114, 115 illinoensis, 115b amplifolius and natans, 120 amplifolius, 121, 123 illinoensis, 132 gramineus v., 142 gramineus, 147, 148, 149 nodosus, 172 gramineus, 173, 184 illinoensis, 190 natans, 192 gramineus, 196 illinoensis.
- Kuntze, Herbarium of Otto.** 3105 perhaps gramineus × illinoensis.
- Laing, H. M.** 147 Richardsonii.
- Lake, E. R.** 614 gramineus.
- Lakela, Olga.** 2731 gramineus.
- Lambert, Bertha B.** 1 amplifolius.
- Lansing, O. E.** 1059 nodosus, 1079, 1779 illinoensis, 4274 natans.
- Lawton, Amy C.** 50 nodosus, 53 Richardsonii.
- Leiberg, J. B.** 751 gramineus, 1574 Richardsonii.
- Leonard & Killip.** 603 nodosus, 863 perfoliatus v. bupleuroides.
- Leonard & Mannakee.** 5489 amplifolius.
- Lewis, H. F.** 130388 natans, 130390, 130391, 130393 alpinus v.

- tenuifolius, 130394, 130395, 130396
gramineus, 130397 perfoliatus.
- Lindheimer, F.** 116, 311, 393
nodosus, 513, 547 illinoensis, 1234
nodosus.
- Linsdale & Keck.** 1 gramineus, 54
amplifolius, 59 illinoensis, 115 am-
plifolius, 127 natans, 153 prae-
longus.
- Long, C. A. E.** 937 natans, 1012
gramineus.
- Long & Linder.** 19679 Oakesianus.
- Looff, Ethel H. & H. B.** 1501
alpinus v. tenuifolius.
- Lorenzo.** 35771 natans.
- Louis-Marie, R.** 313 alpinus v.
tenuifolius, 1255 nodosus.
- Louis-Marie, Laporte & Dude-
maine.** 301 gramineus × perfoli-
atus v. bupleuroides, 302 gramin-
eus, 501 Richardsonii, 1403 gra-
mineus, 1525 perfoliatus.
- Lucien.** 20458 amplifolius.
- Lucy, T. F.** 424 nodosus, 10814
crispus, 10816 nodosus, 10841,
10842 perfoliatus v. bupleuroides
(perhaps perfoliatus v. bupleu-
roides × Richardsonii), 10843 gra-
mineus × perfoliatus v. bupleu-
roides.
- Lunell, J.** 150 gramineus.
- Mabbott, D. C.** 251, 252, 317, 334,
350, 390 Richardsonii, 459 natans,
500 Richardsonii.
- McAtee, W. L.** 977 nodosus, 1060
perfoliatus v. bupleuroides, 1707
illinoensis, 2279, 2337 amplifolius,
2374 nodosus, 2953 crispus, 3074,
3076 gramineus, 3078 natans, 3082
illinoensis, 3201a, 3205 Oakesianus,
3409 illinoensis, 3420 gramineus.
- McCabe, T. T.** 43 alpinus v. tenui-
folius, 47 natans.
- McCalla, W. C.** 2370 Richardsonii.
- MacDaniels, L. H.** 3464 illinoensis.
- MacDougal, D. T.** 44 Richard-
sonii, 80 gramineus approaching v.
maximus, 240 natans, 241 gramin-
eus, 302 Richardsonii, 303 ampli-
folius, 304 gramineus × illinoensis,
462 natans, 543 nodosus, 571
alpinus v. tenuifolius, 638 gramine-
us approaching v. maximus, 639
gramineus, 676 natans, 805, 956
Richardsonii.
- McKay.** 4129 praelongus.
- Mackenzie, K. K.** 293 illinoensis,
359 pulcher, 2305 amplifolius, 3613
gramineus v. maximus, 4377 na-
tans.
- Mackenzie & Griscom.** 10043 na-
tans, 10044 Oakesianus, 10045 am-
plifolius, 10047 alpinus v. subellip-
ticus, 10048 gramineus, 10048a
gramineus approaching v. maxi-
mus, 10049 perfoliatus v. bupleu-
roides.
- McLouth, C. D.** 4 illinoensis.
- MacMillan & Sheldon.** 488 gra-
mineus, 571 Richardsonii, 1332
gramineus v. maximus.
- McMurphy, J.** 192 nodosus, 193
natans.
- Macoun, J. M.** 2975 gramineus,
2979 gramineus × perfoliatus v.
bupleuroides, 2980, 2984, 2992
gramineus, 3020, 3021, 3022, 3026
natans, 3045 Richardsonii, 3047
Richardsonii (perhaps Richard-
sonii × sp.), 3049, 3052, 3054,
3055, 3056 Richardsonii, 4162, 4165
alpinus v. tenuifolius, 4166 alpinus
v. subellipticus, 4178 gramineus ×
sp., 4358 natans, 4362 gramineus
v. maximus, 4368, 4381 Richard-
sonii, 26814 natans, 26815 illino-
ensis (perhaps a hybrid), 26816
gramineus × Richardsonii, 26817
Richardsonii, 80929, 83118 gra-
mineus, 86002 amplifolius.
- Macoun, John.** 8 natans, 9 prae-
longus, 14 illinoensis (this number
also a linear-leaved species accord-
ing to Fernald, Mem. Am. Acad.
Arts & Sci. 17: pt. 1: 55 & 131), 94
alpinus v. tenuifolius, 95 Richard-
sonii, 96 gramineus, 97 gramineus
v. maximus, 98 gramineus ap-
proaching v. maximus, 1730 am-
plifolius, 1733 gramineus approach-
ing v. maximus, 1740 Richardsonii
and perfoliatus v. bupleuroides,
2967 amplifolius, 2970 nodosus,
2971 natans and epiphydus v. Nut-
tallii, 2972, 2974, 2977 gramineus,
2978 gramineus v. maximus, 2981,
2982, 2982a gramineus, 2983, 2986
gramineus × perfoliatus v. bu-
pleuroides, 2991 gramineus, 2993
Oakesianus, 2995, 2996 illinoensis,
3019 natans, 3023 illinoensis, 3024,
3027 natans, 3043 perfoliatus v.
bupleuroides, 3048 Richardsonii,
3053, 3057 Richardsonii, 4128,
4130, 4132, 4132a praelongus, 4163,
4165, 4167, 4167a alpinus v. tenui-
folius, 4168, 4169 alpinus v. subel-
lipticus, 4177 illinoensis, 4179 gra-
mineus × Richardsonii, 4180 illino-
ensis, 4357 natans, 4360 gramineus

- v. *maximus* × *nodosus*, 4364 *amplifolius*, 4365 *alpinus* v. *tenuifolius*, 4379, 4380, 4382 *Richardsonii*, 8006 *alpinus* v. *tenuifolius*, 16441 *gramineus*, 16458, 16459, 16460, 16461 *Richardsonii*, 20748, 20749 *Oakesianus*, 20751 *alpinus* v. *subellipticus* approaching v. *tenuifolius*, 20756 *perfoliatus* v. *bupleuroides*, 22176 *Richardsonii*, 22177 *nodosus*, 22211, 22212 *natans*, 22216, 22217 *gramineus*, 22220 perhaps *alpinus* × *gramineus*, 22221 *amplifolius*, 22227 *perfoliatus* v. *bupleuroides*, 22228, 22229 *amplifolius*, 23173, 23175 *Richardsonii*, 23180 *gramineus*, 26824, 26826 *Richardsonii*, 26830 *crispus*, 26832, 26833 *Richardsonii*, 26834 *amplifolius*, 26839 *nodosus*, 26840 *natans*, 26841, 62015, 62016 *nodosus*, 62021 *illinoensis*, 62022 *natans*, 62023, 62024 *gramineus*, 68425 *natans*, 68919, 78320, 78321 *alpinus* v. *tenuifolius*, 85530 *natans*, 85531 perhaps *alpinus* × *gramineus*, 85534 *amplifolius*, 85535, 85536 *gramineus* v. *maximus*, 85537 *Richardsonii*, 85550 *nodosus*, 88248, 88249, 88250, 88251 *natans*, 88252 *amplifolius*, 88253 *gramineus* v. *maximus*, 88254, 88255 *gramineus*, 88256 *gramineus* approaching v. *maximus*, 88257, 88258, 88259 *praelongus*.
- Macoun & Herriot.** 76868 *gramineus*, 76869 *gramineus* v. *maximus*, 76870, 76871, 76872 *Richardsonii*.
- Maguire, B.** 472 *alpinus* v. *tenuifolius*, 473 *alpinus* v. *subellipticus*, 474 *alpinus* v. *tenuifolius*, 483, 484 *gramineus*, 485, 486 *praelongus*, 488, 490, 491, 495, 496, 497 *Richardsonii*, 13149 *gramineus* v. *maximus*, 16201 *Richardsonii*, 16220 *gramineus* v. *maximus*, 1636 *Richardsonii*.
- Maguire & Piranian.** 5439 *natans*, 5440 *Richardsonii*, 5442 *alpinus* v. *tenuifolius*.
- Maguire, Piranian & Richards.** 12771 *gramineus* v. *maximus*.
- Maguire & Richards.** 13156 *alpinus* v. *tenuifolius*.
- Maguire, Richards, Maguire & Hammond.** 4367 *illinoensis*.
- Malte, M. O.** 118247, 118248, 118249 *perfoliatus* v. *bupleuroides*, 118250, 118251, 118252 *Richardsonii*, 118257 *gramineus*, 118258 perhaps *gramineus* × *illinoensis*, 118259, 118260, 118261, 118262 perhaps *alpinus* × *gramineus*, 118263, 118264 *gramineus* v. *maximus*, 118265 *gramineus*, 118266 *gramineus* v. *maximus*, 118267, 118268 *amplifolius*, 118269, 118270 *natans*, 118273, 118274, 118275 *nodosus*.
- Malte & Watson.** 960, 1276, 1818 *Richardsonii*.
- Markert, W. C.** 76909 *perfoliatus* v. *bupleuroides*.
- Martin, A. C.** 158 *natans*.
- Martindale, I. C.** 12003 *amplifolius*.
- Mathias, Mildred E.** 265 *natans*.
- Maxon, William R.** 4617 *Richardsonii*.
- Mearns, E. A.** 805 *nodosus*.
- Merrill & Wilcox.** 863 *Richardsonii*, 902 *gramineus*.
- Mertie, J. B.** 66 *Richardsonii*.
- Metcalfe, F. P.** 8 *illinoensis*, 9 *Richardsonii*, 14 *praelongus*, 50 *natans*, 193, 304, 322, 339 *Richardsonii*, 345, 355 *gramineus*, 404 *Richardsonii*, 423 *gramineus*, 432, 451 *Richardsonii*, 471 *gramineus*, 512 *Richardsonii*, 522 *praelongus*, 542 *Richardsonii*, 544 *natans*, 546 *praelongus*, 547 *Richardsonii*, 636, 819, 842, 845 *nodosus*, 888, 929 *amplifolius*, 948 *crispus*, 1018, 1024 *nodosus*, 1055 *illinoensis* × *nodosus*, 1071, 1105 *nodosus*, 1139 *natans*, 1140 *amplifolius*, 1145 *Richardsonii*, 1147 *praelongus*, 1160 *amplifolius*, 1162 *gramineus*, 1176 *Richardsonii*, 1229 *praelongus*, 1291 *pulcher*, 1295 *natans*, 1297, 1298, 1329, 1370 *illinoensis*, 1373 *gramineus*, 1379, 1383 *illinoensis*, 1388 *natans*, 1390 *Richardsonii*, 1391 *illinoensis*, 1412 *gramineus*, 1413 *praelongus*, 1415 *gramineus* v., 1420, 1427 *illinoensis*, 1428 *gramineus*, 1432 *illinoensis*, 1463 *Richardsonii*, 1464 *gramineus*, 1470 *illinoensis*, 1471 *nodosus*, 1472 *gramineus*, 1511 *amplifolius*, 1520 *gramineus*, 1532 *gramineus* × *illinoensis*, 1542, 1543, 1551, 1563, 1564 *illinoensis*, 1780, 1794, 1839, 1908, 1937 *Richardsonii*, 1962 *natans*, 1963, 1979, 1991 *Richardsonii*.

- sonii, 2014 illinoensis, 2024 amplifolius, 2039 illinoensis, 2044 Richardsonii, 2046 nodosus, 2048 illinoensis, 2049 natans, 2050 gramineus, 2055 illinoensis, 2065 natans, 2076 illinoensis, 2093 praelongus, 2105 gramineus, 2107 illinoensis, 2113 natans, 2124 Richardsonii, 2132 praelongus, 2147 illinoensis, 2187 gramineus, 2201 natans, 2209, 2210 amplifolius, 2211 natans, 2226 Richardsonii, 2242, 2250 amplifolius, 2251, 2252 illinoensis, 2253 gramineus \times illinoensis, 2254, 2255 amplifolius, 2256 gramineus \times illinoensis, 2259 gramineus, 2291 praelongus, 2302 natans, 2311 perhaps praelongus \times sp., 2316 praelongus, 2317 illinoensis, 2318 gramineus, 2321 amplifolius, 2324, 2326 gramineus, 2340 Richardsonii, 2341 illinoensis, 2342 natans, 2345 illinoensis, 2352 nodosus, 2353 Richardsonii, 2356, 2370 illinoensis, 2371 praelongus, 2373 gramineus \times illinoensis, 2377, 2379 illinoensis, 2381, 2387 praelongus, 2388, 2396 illinoensis.
- Metcalf & Sperry.** 1603 perfoliatus v. bupleuroides, 1621 amplifolius, 1622, 1630 nodosus, 1631 crispus, 1634, 1639 amplifolius, 1684 gramineus \times perfoliatus v. bupleuroides, 1690 illinoensis.
- Michel.** 1356 perfoliatus v. bupleuroides, 1993 amplifolius.
- Millman.** 2976 gramineus.
- Millspaugh, C. F.** 457 nodosus.
- Moffatt, W. S.** 294 amplifolius.
- Moldenke, H. N.** 752 illinoensis, 4207 gramineus v. maximus, 4208, 9396 nodosus, 9397 perfoliatus v. bupleuroides.
- Moore, A. H.** 89 natans, 945 crispus, 2488 amplifolius, 5022 gramineus, 5036 amplifolius.
- Moore, E.** 1488 natans.
- Moore, G.** 81 amplifolius.
- Moore & Steyermark.** 3667 illinoensis.
- Morris, E. L.** A41 natans, 1343 perhaps gramineus \times nodosus (possibly illinoensis \times nodosus).
- Mosier, C. A.** 352 illinoensis.
- Moyle, J. B.** 61a Richardsonii, 894 alpinus v. tenuifolius, 2052 illinoensis, 2261 amplifolius.
- Muenschner, W. C.** 2739 crispus, 7632 natans, 7633, 7634, 7635 amplifolius, 7640 gramineus approaching v. myriophyllus, 7642 gramineus, 7643, 7644 natans, 7647 praelongus, 7653, 7654, 7655 Richardsonii, 7657a, 7658 alpinus v. tenuifolius, 10202 natans, 10204 Richardsonii, 10207 gramineus, 10208 gramineus \times illinoensis, 10209, 10210, 10211 gramineus, 10212 gramineus \times illinoensis, 10216 gramineus, 10218 Richardsonii, 17098 illinoensis, 17104, 17106 gramineus, 17121 Richardsonii, 17545 illinoensis, 17550 gramineus, 17556 praelongus, 17671 natans, 17676 praelongus, 17678 Richardsonii.
- Muenschner & Bechtel.** 433 nodosus, 434 gramineus, 459 Richardsonii.
- Muenschner & Burkholder.** 16401 illinoensis, 16846 crispus, 16885 Richardsonii.
- Muenschner & Clausen.** 3751, 3752 nodosus, 3756 illinoensis, 3757, 3758, 3759 perfoliatus v. bupleuroides, 3770 gramineus v. maximus, 3772 gramineus (perhaps v. myriophyllus), 3773 gramineus approaching v. myriophyllus, 3775 gramineus v., 3784 perhaps amplifolius \times Richardsonii, 4161, 4164 amplifolius, 4167 perfoliatus v. bupleuroides, 4190 gramineus, 4205 praelongus, 4209 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii, 4210 perfoliatus v. bupleuroides, 4232, 4233, 4235, 4238 illinoensis).
- Muenschner & Curtis.** 4827, 4828 nodosus, 4841 gramineus v. maximus, 5423 amplifolius, 5425, 5427 illinoensis, 5430, 5433, 5436 perfoliatus v. bupleuroides, 5466 praelongus, 4835 illinoensis, 4837 amplifolius, 4839, 4843, 4844 illinoensis, 4876 gramineus approaching v. myriophyllus, 4877, 4880 gramineus, 4900 praelongus, 4918 perhaps gramineus \times perfoliatus v. bupleuroides.
- Muenschner & Lindsey.** 2712 alpinus v. tenuifolius, 2715 perhaps gramineus \times nodosus, 2716 nodosus, 2719, 2723, 2724 amplifolius, 2725a illinoensis, 2726 perhaps perfoliatus v. bupleuroides \times Richardsonii, 2728, 2730, 2732 perfoliatus v. bupleuroides, 2739 crispus, 2769 gramineus v. maximus, 2770

- gramineus \times perfoliatus v. *bupleuroides*, 2775 gramineus v. *myriophyllus*, 2777 gramineus approaching v. *maximus*, 2780 gramineus approaching v. *myriophyllus*, 2782 gramineus, 2785 gramineus approaching v. *myriophyllus*, 2786 gramineus \times *illinoensis*, 2788 natans, 2799 Oakesianus, 2814a praelongus, 2814b perhaps *amplifolius* \times praelongus, 2819, 2820 praelongus, 2830 Richardsonii, 2863 alpinus v. *tenuifolius*, 2865 gramineus \times perfoliatus v. *bupleuroides*.
- Muenschner & Maguire.** 713, 715 gramineus v. *maximus*, 717, 718, 719, 721, 722, 723 *amplifolius*, 726 alpinus v. *tenuifolius*, 729 Richardsonii (perhaps perfoliatus v. *bupleuroides* \times Richardsonii), 730, 732 perfoliatus v. *bupleuroides*, 778 gramineus, 781 gramineus approaching v. *maximus*, 782 gramineus, 787 gramineus approaching v. *maximus*, 789, 793 gramineus, 796, 797, 800, 804, 805, 809, 812, 813 natans, 825, 827, 829, 831, 834 praelongus, 857, 858 gramineus, 1582 perhaps gramineus \times perfoliatus v. *bupleuroides*, 1583, 1588, 1591, 1592 *nodosus*, 1593, 1593a, 1594, 1599, 1600, 1601 *amplifolius*, 1604b, 1605, 1606 *illinoensis*, 1607c, 1608, 1609 perfoliatus v. *bupleuroides*, 1618 *crispus*, 1676 *illinoensis*, 1677, 1679 gramineus, 1680 *illinoensis*, 1683 gramineus, 1684 gramineus \times *illinoensis*, 1686, 1689, 1690 gramineus, 1691 gramineus approaching v. *maximus*, 1692, 1693 gramineus v. *maximus*, 1695 gramineus, 1696 gramineus approaching v. *maximus*, 1699 gramineus, 1700, 1701 *illinoensis*, 1703, 1705, 1706, 1709, 1710 natans, 1711, 1715, 1716, 1717 Oakesianus, 1747, 1748 praelongus, 1751 *illinoensis*, 1753, 1754, 1756 praelongus, 1773, 1775, 1776, 1779, 1781, 1782 Richardsonii, 1783 perhaps perfoliatus v. *bupleuroides* \times Richardsonii, 1787 Richardsonii, 1806 *illinoensis*.
- Muenschner, Manning & Maguire.** 67, 71 *amplifolius*, 73, 75 gramineus \times *illinoensis*, 120 gramineus approaching v. *maximus*, 141 praelongus, 157 perhaps perfoliatus v. *bupleuroides* \times Richardsonii.
- Muenschner & Wiegand.** 14538 perhaps gramineus \times sp.
- Munz, P. A.** 2785 *crispus*, 10805 *illinoensis*.
- Murdoch, J.** 524 perfoliatus v. *bupleuroides*, 939 *amplifolius*, 2062 Oakesianus.
- Nash, G. V.** 786 *crispus*, 859, 1750 *illinoensis*.
- Nelson, A.** 2276 Richardsonii, 2406 gramineus v., 4145 natans.
- Nelson, A. & E.** 6061 gramineus v. *maximus*, 6770 natans (ecological form, perhaps a hybrid), 6771 perhaps gramineus \times *illinoensis*, 6807 Richardsonii.
- Nelson, A. & Ruth A.** 973 praelongus.
- Nelson, E.** 87, 3362 Richardsonii, 3386 *illinoensis*.
- Nelson, J. C.** 1840 Richardsonii.
- Nichols, G. E.** 694 perfoliatus v. *bupleuroides*, 749, 875 natans, 876 gramineus, 1037 gramineus \times perfoliatus v. *bupleuroides*.
- Northrop, J. I.** 79 natans.
- Ogden, E. C.** 914, 964 gramineus v. *maximus*, 1502 *crispus*, 1620 natans, 1701 perfoliatus v. *bupleuroides*, 1702 alpinus v. *tenuifolius*, 1704 *amplifolius*, 1705 natans, 1716 gramineus, 1717 Richardsonii, 1718 natans, 1725 alpinus v. *tenuifolius*, 1887 Oakesianus.
- Ogden & Babel.** 2166 Oakesianus, 2203 gramineus.
- Ogden, Babel & Chamberlain.** 2242 alpinus v. *tenuifolius*.
- Ogden, Babel & Kozicky.** 1880 praelongus.
- Ogden & Bolan.** 1560, 1562 Oakesianus, 1565 natans, 1568 *nodosus*, 1569 *illinoensis*, 1571 perfoliatus v. *bupleuroides* (perhaps perfoliatus v. *bupleuroides* \times Richardsonii), 1578 gramineus \times perfoliatus v. *bupleuroides*, 1580 natans, 1582 Richardsonii, 1583 *amplifolius*, 1584 *nodosus*, 1589 Richardsonii, 1589½ *illinoensis* \times *nodosus*, 1590, 1629, 1630 *nodosus*, 1631, 1643 Richardsonii, 1644, 1645 gramineus, 1646 natans, 1647 *amplifolius*, 1676 natans, 1677 gramineus, 1678 Richardsonii, 1680 gramineus, 1681 gramineus \times Richardsonii.
- Ogden & Hubert.** 1537 perfoliatus v. *bupleuroides*, 1538 *crispus*.
- Ogden & Marston.** 432 perfoli-

- atus v. bupleuroides, 492 praelongus, 493 perfoliatus v. bupleuroides, 1691 gramineus, 1692, 1693 amplifolius, 1694 gramineus v. maximus, 1698 gramineus.
- Ogden, E. C. & Edith B.** 1762 gramineus \times illinoensis, 1765 gramineus v. myriophyllus, 2008 perfoliatus v. bupleuroides, 2013 gramineus, 2016 amplifolius, 2020 praelongus, 2032 perfoliatus v. bupleuroides.
- Ogden, Ogden & Babel.** 2271 natans, 2272 amplifolius, 2294 Richardsonii, 2308 gramineus.
- Ogden, Ogden & Steinmetz.** 1882 praelongus.
- Ogden & Palmer.** 1505 perfoliatus v. bupleuroides, 1506 natans.
- Ogden, Rollins & Wiggins.** 1731 Berchtoldi \times perfoliatus v. bupleuroides, 1732 perfoliatus v. bupleuroides.
- Ogden & Steinmetz.** 1542 natans, 1543 gramineus v. maximus, 1544 perfoliatus v. bupleuroides, 1544½ gramineus \times perfoliatus v. bupleuroides, 1545 gramineus, 1547 amplifolius, 1548 natans, 1549 gramineus, 1552 gramineus v. maximus, 1556 amplifolius, 1592 praelongus, 1593, 1602, 1603 gramineus v. maximus, 1604 praelongus, 1605 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides \times Richardsonii), 1607 perhaps gramineus \times nodosus, 1612 gramineus, 1613, 1614 amplifolius, 1615 natans, 1772 Oakesianus, 2189 gramineus v. maximus, 2190 nodosus, 2191 gramineus approaching v. maximus, 2192 perfoliatus v. bupleuroides, 2193 gramineus v. maximus, 2195 gramineus \times perfoliatus v. bupleuroides.
- Ogden, Steinmetz & Prince.** 1596 nodosus, 1597 gramineus v. maximus.
- Ogden & Trask.** 2073 Oakesianus.
- Ogden & Wiggins.** 1729 amplifolius.
- Ogden & Wright.** 2342 gramineus \times perfoliatus v. bupleuroides (perhaps alpinus \times gramineus), 2343 alpinus v. tenuifolius, 2344 gramineus v. maximus.
- Oosting, H. J.** 291 gramineus, 302 Richardsonii, 2938, 2945 illinoensis, 2971 Richardsonii, 28100 gramineus, 28164 gramineus \times illinoensis, 28166 gramineus.
- Ostenfeld, C. H.** 553 Richardsonii.
- Osterhout, G. E.** 2885 alpinus v. tenuifolius.
- Otis, I. C.** 1565 natans, 1583 Richardsonii, 1584 gramineus, 1678 Richardsonii, 1767 praelongus, 1768, 1769 amplifolius.
- Over, W. H.** 3366, 3367 Richardsonii, 4008 illinoensis, 4044 gramineus, 13817 alpinus v. tenuifolius approaching v. subellipticus, 13818 Richardsonii, 14459 amplifolius, 14460, 14464 Richardsonii, 14466 gramineus, 15425 amplifolius, 15867 gramineus approaching v. maximus, 17129 gramineus v., 17130, 17131, 17132, 17133, 17134, 17135, 17136, 17137 Richardsonii, 17138 gramineus, 17139 natans, 17140 gramineus, 17141, 17142 amplifolius, 17432 nodosus.
- Palmer, E. J.** 11952 nodosus, 12217 illinoensis, 12907 perhaps illinoensis \times nodosus, 21526 nodosus, 33310 pulcher, 33707, 43586 nodosus.
- Palmer, E. L.** 36, 37, 38 natans, 50 Richardsonii.
- Palmer, L. J.** 638 gramineus v. maximus and Richardsonii, 1862 Richardsonii, 1866 gramineus.
- Palmer & Steyermark.** 41417 pulcher.
- Pammel, L. H.** 100 natans, 776 illinoensis.
- Parish, S. B.** 2106, 2128, 3350 nodosus, 3414 natans.
- Parish, S. B. & W. F.** 1435 natans.
- Parlin, J. C.** 1073 perfoliatus v. bupleuroides.
- Parlin & Fernald.** 924 natans.
- Payson, E.** 174 illinoensis.
- Payson, E. B. & Lois B.** 2023 Richardsonii, 2024 praelongus, 2251 natans.
- Pease, A. S.** 1919 alpinus v. subellipticus, 2011 pulcher, 2064 crispus, 2500 gramineus, 2589 gramineus v. maximus, 2907 alpinus v. tenuifolius, 3795 natans, 4699A Oakesianus, 5314A gramineus, 11982 Richardsonii, 12143 perfoliatus v. bupleuroides, 12171 Oakesianus, 13821 gramineus, 13883 amplifolius, 14012 praelongus, 14582 gramineus, 14585 amplifolius, 16591, 16943 perfoliatus v. bupleuroides,

- 17024 alpinus v. tenuifolius approaching v. subellipticus, 17185 amplifolius, 17270 alpinus v. tenuifolius approaching v. subellipticus, 17983 Richardsonii, 20073 natans, 22752, 22753, 22754 gramineus, 25217 natans, 26709 alpinus v. tenuifolius.
- Pease & Bean.** 26092 gramineus, 26094 Richardsonii, 26199 amplifolius, 26247 Richardsonii, 26304 gramineus, 26389 Richardsonii.
- Pease & Edgerton.** 27169 gramineus.
- Pease & Fernald.** 16958 amplifolius, 17024 alpinus v. tenuifolius approaching v. subellipticus, 17047 natans.
- Pease & Hopkins.** 22692 perfoliatus v. bupleuroides.
- Pease & Ogden.** 24828 Richardsonii, 24911 gramineus, 24918 Richardsonii, 24964 illinoensis, 24965 natans, 25013, 25031 Richardsonii, 25032 amplifolius, 25135 Oakesianus, 25167 amplifolius.
- Peattie, D. C.** 235 Richardsonii, 2305 gramineus v. myriophyllus.
- Peck, C. H.** 2 perhaps alpinus \times nodosus, 3 illinoensis.
- Peck, M. E.** 6284 Richardsonii, 8514 natans, 9009 Richardsonii, 9026 amplifolius, 9619 Richardsonii.
- Peebles, R. H.** 14190 nodosus.
- Pennell, F. W.** 3351 perfoliatus v. bupleuroides, 16220 Richardsonii, 16332 gramineus, 16333 gramineus \times illinoensis, 16664 gramineus.
- Pepoon, H. S.** 156, 159 illinoensis, 899 praelongus.
- Perry & Roscoe.** 38 Oakesianus.
- Phelps, O. P.** 1091 nodosus, 1092, 1655 perfoliatus v. bupleuroides, 1665 nodosus.
- Pieters, A. J.** 3 Richardsonii, 6 gramineus, 7 illinoensis.
- Piper, C. V.** 757 Richardsonii, 758 natans, 3684 amplifolius, 3761 gramineus \times illinoensis, 3765 natans, 4426 alpinus v. tenuifolius, 4430 Richardsonii, 4431 gramineus approaching v. maximus.
- Polunin, N.** 1976, 2062 alpinus v. tenuifolius, 2070 perhaps alpinus \times gramineus.
- Pontious & Bartley.** 18 nodosus.
- Porsild, A. E.** 4295 gramineus approaching v. maximus (perhaps gramineus \times sp.), 4296 alpinus v. subellipticus.
- Porsild, A. E. & R. T.** 114 alpinus v. tenuifolius, 847 Richardsonii, 943, 1102 Richardsonii, 1131 gramineus, 1496 alpinus v. tenuifolius, 1497 gramineus, 2955 praelongus, 3098 alpinus v. tenuifolius and Richardsonii, 3099, 5174 gramineus v. maximus.
- Prince & Atwood.** 1318 Oakesianus, 1405 perfoliatus v. bupleuroides.
- Prince & Hyland.** 649 gramineus.
- Proulx, T.** 58 alpinus v. tenuifolius.
- Rand & Robinson.** 1013 pulcher
- Randolph & Wiegand.** 9094 nodosus.
- Rapp, F. W.** 1977, 1979 praelongus, 1990, 2005, 2008 amplifolius, 2031 natans, 2035 amplifolius, 2221 natans, 2232 amplifolius, 2238, 2251, 2262 natans, 2267, 2273, 2292 amplifolius.
- Rau, E. A.** 88 perfoliatus v. bupleuroides.
- Raup, H. M.** 1545 perhaps alpinus v. subellipticus, 1546 gramineus v. maximus, 1547 gramineus \times Richardsonii, 1548 gramineus v. maximus, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560 Richardsonii, 1570, 1571, 1572 praelongus, 6352, 6497-a Richardsonii. 6498-a alpinus v. tenuifolius, 6617 Richardsonii, 6618, 6621, 6622, 6741 alpinus v. tenuifolius, 6742 alpinus v. subellipticus, 6823, 6849, 7002 gramineus.
- Raup & Abbe.** 4038 gramineus, 4313 natans, 4614 gramineus, 4666 Richardsonii.
- Redfield, J. H.** 7996 pulcher, 8002 perfoliatus v. bupleuroides, 8014 alpinus v. subellipticus, 15341 perfoliatus v. bupleuroides.
- Reed, E. L.** 3168 nodosus.
- Reverchon, J.** 1640 illinoensis, 2502 pulcher.
- Ricard & Boivin.** 342 nodosus.
- Ricker, P. L.** 600 natans.
- Rider, Sadie L.** 349 Richardsonii.
- Ridgway, R.** 3318 nodosus.
- Ridgway & Eaton.** 3425 nodosus.
- Riehl, N.** 128 pulcher.
- Robinson, B. L.** 494 natans.
- Robinson & Maxon.** 114 natans.
- Robinson & Schrenk.** 207 perfoliatus v. bupleuroides, 231 poly-

- gonifolius, 232 gramineus approaching v. maximus.
- Robinson & Webb.** 1087 perfoliatus v. bupleuroides (perhaps a hybrid).
- Rolland-Germain.** 6231 gramineus, 6233, 6235 gramineus v. maximus, 6280 amplifolius, 8696 perfoliatus v. bupleuroides, 8697, 13044 amplifolius, 16055 Richardsonii, 16058 alpinus v. tenuifolius, 16061 natans, 19251 gramineus approaching v. maximus, 19269 nodosus, 43354, 43356 Richardsonii, 43357 perfoliatus v. bupleuroides, 43358 perhaps alpinus \times perfoliatus v. bupleuroides, 43359 nodosus, 43360 perhaps gramineus \times perfoliatus v. bupleuroides, 43361 gramineus \times perfoliatus v. bupleuroides, 43363 natans, 43367, 43368, 43376 gramineus \times perfoliatus v. bupleuroides, 43377 perhaps gramineus \times perfoliatus v. bupleuroides, 43378 gramineus \times perfoliatus v. bupleuroides, 43379, 43380, 43381 perhaps gramineus \times perfoliatus v. bupleuroides, 43382 gramineus \times perfoliatus v. bupleuroides, 43481 Richardsonii.
- Rollins, R. C.** 2319 alpinus v. tenuifolius.
- Rollins & Chambers.** 2590 natans.
- Rose & Painter.** 8205 nodosus.
- Rosendahl, C. O.** 790 natans.
- Rosendahl & Butters.** 4638 gramineus v. maximus.
- Rosvinge, L. K.** 2990 gramineus.
- Roszbach, G. B.** 51 gramineus v., 55 natans, 59 alpinus v. subellipticus, 60 natans, 61, 62, 63 amplifolius, 70, 71, 72 gramineus, 73 gramineus v. maximus, 74 perfoliatus v. bupleuroides, 75 gramineus, 76, 77, 78 perfoliatus v. bupleuroides, 82 praelongus.
- Roszbach, G. B. & R. P.** 16 alpinus v. tenuifolius, 17 gramineus, 20 gramineus v. maximus.
- Rothrock, J. T.** 67 Richardsonii.
- Rouleau, E.** 304 nodosus, 1185 perfoliatus v. bupleuroides.
- Roush, Eva M. F.** 812 natans.
- Rousseau, J.** 20444, 20445 gramineus \times perfoliatus v. bupleuroides, 20448 amplifolius, 25814 Oakesianus, 25817, 30003 natans, 30004 praelongus, 31207, 32297 gramineus, 32332 alpinus v. tenuifolius, 32303 perhaps gramineus \times perfoliatus v. bupleuroides, 35293 Oakesianus, 35812 perfoliatus v. bupleuroides.
- Rugel, F.** 613 illinoensis.
- Rust, H. J.** 384 alpinus v. subellipticus, 385 natans.
- Ruth, A.** 49, 56, 141, 772 nodosus.
- Rydberg, P. A.** 1421 nodosus, 1440 illinoensis, 1652 natans, 1792 Richardsonii, 1846 nodosus.
- Rydberg & Bessey.** 3724, 3725 alpinus v. tenuifolius.
- Rydberg & Carlton.** 7522 Richardsonii.
- St. Cyr, D. N.** 2973 gramineus, 2994 amplifolius, 3030 nodosus, 3050 Richardsonii.
- St. John, H.** 1121, 1122 polygonifolius, 1124 perfoliatus v. bupleuroides, 1372 natans, 1373 Oakesianus, 1756 alpinus v. subellipticus, 1758 gramineus approaching v. maximus, 2540, 2542 perfoliatus v. bupleuroides, 11919 gramineus v. myriophyllus, 90081 natans, 90083, 90084 alpinus v. tenuifolius, 90085 alpinus v. subellipticus, 90086 gramineus, 90087 perfoliatus.
- St. John, English, Moore & Palmer.** 9740 natans.
- St. John & Nichols.** 2104 alpinus v. tenuifolius, 2105 perfoliatus v. bupleuroides, 2106 natans, 2107 praelongus, 2108 amplifolius, 2109 gramineus v. maximus.
- Sandberg, J. H.** 33 amplifolius, 225 Richardsonii, 498 gramineus, 636 Richardsonii, 656, 658 amplifolius, 801 Richardsonii, 4927 praelongus.
- Sandberg & Leiber.** 524 gramineus v. maximus.
- Sandberg, MacDougal & Heller.** 697, 939 natans, 955 gramineus, 956 Richardsonii, 1026 gramineus.
- Sanford, S. N. F.** 1225, 10192 perfoliatus v. bupleuroides.
- Sargent, H. E.** 29 perfoliatus v. bupleuroides, 31 gramineus \times perfoliatus v. bupleuroides, 33 perfoliatus v. bupleuroides.
- Schulz, Ellen D.** 797 illinoensis.
- Scott, W.** 16208 crispus, 16431 nodosus, 16432 amplifolius, 16433, 16434 illinoensis, 16438, 16439 crispus, 16443 gramineus, 16444 gramineus v. maximus, 16446,

- 16447 gramineus, 16448 illinoensis, 16450 gramineus, 16451 praelongus, 16454, 16455, 16457 Richardsonii.
- Scovell, J. T.** 26 amplifolius and natans, 27a Richardsonii, 28 amplifolius, 32 nodosus, 37 gramineus \times illinoensis, 44 gramineus, 45 praelongus, 53 (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 136), 54 illinoensis, 66 praelongus.
- Scovell & Clark.** 1057 Richardsonii, 1079 illinoensis, 1221 gramineus, 1223 amplifolius, 1321 praelongus.
- Seargent, M.** 100 nodosus.
- Seymour, F. C.** 249 amplifolius, 267, 1027 perfoliatus v. bupleuroides, 1487, 1567, 1568 Oakesianus, 1570 perfoliatus v. bupleuroides, 3868 praelongus, 4151 pulcher, 4941 gramineus approaching v. myriophyllus.
- Sharp, W. M.** 3 Richardsonii, 11 illinoensis, 73, 100 natans, 101 praelongus.
- Sharp & Underwood.** 33521 nodosus.
- Sharples, S. P.** 303 nodosus.
- Shaw, C. H.** 771 Richardsonii, 1200 natans and gramineus.
- Shear, C. L.** 3745 nodosus, 3804 praelongus, 4524 alpinus v. tenuifolius.
- Shear & Bessey.** 5328 alpinus v. tenuifolius, 5333 gramineus \times Richardsonii.
- Shreve, F.** 1597, 1622 pulcher.
- Shull, G. H.** 15 crispus, 39, 95 nodosus, 96 perfoliatus v. bupleuroides, 97 amplifolius, 198 nodosus, 316 perfoliatus v. bupleuroides, 413 amplifolius, 421 nodosus, 431, 456 perfoliatus v. bupleuroides, 465 crispus, 469 perfoliatus v. bupleuroides, 471 illinoensis \times nodosus, 473 amplifolius, 474 nodosus.
- Shunk & Manning.** 70 Richardsonii, 80 praelongus, 83 natans, 220 Richardsonii, 225 natans, 229 praelongus, 236 Richardsonii, 237 illinoensis, 298 gramineus, 307 illinoensis, 328 gramineus, 337 natans, 368 praelongus, 398 Richardsonii, 410 praelongus, 492 Richardsonii, 495 illinoensis, 505 praelongus, 511 Richardsonii, 553 amplifolius, 560 Richardsonii.
- Simpson, J. H.** 386 illinoensis.
- Small, J. K.** 7241, 8170 illinoensis.
- Small & Carter.** 1007, 1118 illinoensis.
- Small, J. K. & G. K.** 4143, 4437, 4486 illinoensis.
- Smiley, F. J.** 330 natans, 749 nodosus.
- Smith, E. F.** 57 praelongus.
- Smith, L. B.** 632 natans.
- Smith & Pound.** 228 natans.
- Sones, G. D.** 307 nodosus.
- Sperry, C. C.** 509 pulcher.
- Sperry & Martin.** 671 Richardsonii, 696 praelongus, 718 Richardsonii, 719 gramineus, 731, 735 illinoensis.
- Spreadborough, W.** 16429 alpinus v. tenuifolius, 20750 gramineus, 62662, 62663 Richardsonii.
- Standley, P. C.** 7557 gramineus v., 9780 nodosus, 16855, 17398 alpinus v. tenuifolius, 18500 natans, 18528 amplifolius, 40488 illinoensis, 40649 gramineus.
- Standley & Killip.** 7648 amplifolius, 7649 nodosus.
- Stecker, A.** 332 alpinus v. tenuifolius.
- Steenis, J. H.** 4741 alpinus v. tenuifolius, 4781 Richardsonii.
- Steinmetz, F. H.** 94 amplifolius, 149 gramineus \times sp., 320 gramineus \times perfoliatus v. bupleuroides (perhaps alpinus \times gramineus), 323 alpinus v. tenuifolius, 351 gramineus, 356 gramineus v. maximus, 357 gramineus \times sp., 358 gramineus, 365 gramineus v. maximus, 367 amplifolius, 370 gramineus, 374 perfoliatus v. bupleuroides, 381 gramineus, 385 perfoliatus v. bupleuroides, 404 gramineus v., 412 amplifolius, 420, 526 perfoliatus v. bupleuroides, 527 perhaps gramineus \times nodosus, 617 Berchtoldi \times perfoliatus v. bupleuroides, 626 amplifolius, 627 gramineus, 630 natans, 732 gramineus v. maximus, 791 perhaps perfoliatus v. bupleuroides \times Richardsonii, 830 natans, 950 amplifolius, 957 nodosus, 1127 Oakesianus.
- Steinmetz & Babel.** 888 gramineus \times perfoliatus v. bupleuroides, 889 perfoliatus v. bupleuroides, 905 nodosus.
- Steinmetz & Marston.** 539 Berchtoldi \times perfoliatus v. bupleuroides.

- Steinmetz & Ogden.** 98 amplifolius.
- Steinmetz & Quimby.** 581 gramineus, 582 praelongus.
- Steinmetz & Swanson.** 30 natans, 31 nodosus, 55 gramineus.
- Stevens, G. W.** 1364 amplifolius and nodosus.
- Steyermark, J. A.** 1003 natans, 4227 crispus, 4327 pulcher, 4473 natans, 4609 illinoensis, 4639, 4688, 4728 amplifolius, 5410 nodosus (perhaps illinoensis \times nodosus), 5411, 9233 nodosus, 11323, 11939 illinoensis, 11946 amplifolius, 12031, 12428 illinoensis, 13782, 13869 amplifolius, 13910, 13938, 14226 illinoensis, 14245 pulcher, 14257, 14259 nodosus, 14285 illinoensis, 14487, 14624, 15560 amplifolius, 16313 crispus, 21087, 21138, 21145 illinoensis, 21208 amplifolius, 21235 illinoensis, 21269 amplifolius, 22031 nodosus, 22773, 22840, 22873, 23321, 23365 amplifolius, 23494, 23543, 23546 amplifolius, 24650 nodosus, 25008 amplifolius, 25009 illinoensis, 25102, 25103 nodosus, 25104, 25142 illinoensis, 25249, 25250, 25317 nodosus, 25365 illinoensis, 25367 nodosus, 25370 illinoensis, 25425 nodosus, 25533 amplifolius, 25534, 25603, 25876, 27148, 27635, 27657, 27901 nodosus, 27967, 28004, 28005 illinoensis, 28009a nodosus, 28026, 28034a, 28044 illinoensis, 28071 amplifolius, 28080 illinoensis.
- Street & Williams.** 2689 nodosus.
- Suksdorf, W. N.** 728 nodosus, 2172 alpinus v. tenuifolius.
- Svenson, H. K.** 156 pulcher, 7216 nodosus, 9108, 9427, 10150 pulcher.
- Svenson & Fassett.** 932 perfoliatus v. bupleuroides, 933 perfoliatus, 934 nodosus, 3025 gramineus \times perfoliatus v. bupleuroides, 3028 alpinus v. subellipticus, 3030 gramineus \times perfoliatus v. bupleuroides, 3031 3040 perfoliatus v. bupleuroides, 3045 Richardsonii, 3046 gramineus.
- Svenson & Smith.** 822 perfoliatus v. bupleuroides.
- Tanner, V. M.** 5786 praelongus \times Richardsonii.
- Taylor, W. P.** 78 gramineus \times illinoensis.
- Taylor, Hosie, Fitzpatrick, Losee & Leslie.** 280 amplifolius, 291 gramineus, 293 Richardsonii, 294 alpinus v. subellipticus, 295, 296 natans, 297 Oakesianus, 299 gramineus, 300 Richardsonii, 303 gramineus, 304 gramineus \times Richardsonii (probably backcrossed with gramineus), 305 gramineus.
- Tharp, B. C.** 2181 illinoensis.
- Thomas, C. C.** 1494 perhaps gramineus \times nodosus, 1499 gramineus, 3466 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides \times Richardsonii).
- Thompson, H. D.** 8 Richardsonii.
- Thompson, J. W.** 7589 gramineus, 7594 Richardsonii, 8620 amplifolius, 9422 $\frac{1}{2}$ natans, 11768 gramineus v. maximus, 14046g gramineus.
- Thomson, R.** 2 praelongus, 5 Richardsonii, 7 natans, 16 gramineus, 53 illinoensis, 69 gramineus, 73b gramineus \times illinoensis, 142 Richardsonii, 145 illinoensis, 153 gramineus, 222 Richardsonii, 232 natans, 253 gramineus, 299 Richardsonii, 361, 365 gramineus, 369 Richardsonii, 382 natans.
- Thurber, G.** 48 illinoensis.
- Tidestrom, I.** 517, 1861 illinoensis, 7171 nodosus, 7175 perfoliatus v. bupleuroides, 7183, 7637, 7741, 10655 nodosus.
- Tolstead, W. L.** 428 natans, 429 Richardsonii, 430 praelongus, 473 Richardsonii, 614 illinoensis, 615 gramineus, 616 gramineus \times illinoensis, 637 nodosus, 638 natans, 41500 nodosus.
- Topping, D. L.** 203 amplifolius.
- Toumey, J. W.** 496 nodosus.
- Tracy, J. P.** 4406 natans.
- Trelease, W.** 2865, 2867 gramineus, 2870, 2871 alpinus v. tenuifolius.
- Tweedy, F.** 45 illinoensis, 411 gramineus, 413 Richardsonii, 4978 gramineus.
- Uhler & McLaughlin.** 362, 373 Richardsonii, 375, 1091 gramineus \times illinoensis.
- Uhler & Martin.** 1645 Richardsonii, 1656 gramineus, 1659 Richardsonii, 1660 natans, 1662 illinoensis, 1666 gramineus (perhaps gramineus \times illinoensis).
- Uhler & Warren.** 793 natans, 797 $\frac{1}{2}$ praelongus, 858 illinoensis, 1079 praelongus.

- Umbach, L. M.** 31 gramineus, 433 Richardsonii, 457 gramineus v. maximus.
- Van Dyke, E. C.** 202 alpinus v. tenuifolius.
- VanElseltine & Moseley.** 201 crispus, 202 nodosus.
- Victorin, Marie-** 526 gramineus, 565 perfoliatus v. bupleuroides, 1124 gramineus, 1152, 1505 alpinus v. tenuifolius, 1537 natans, 1539 gramineus, 3177 perfoliatus v. bupleuroides, 3231 Richardsonii, 4195, 7330 gramineus, 8176 gramineus \times perfoliatus v. bupleuroides, 8177, 8178 perfoliatus v. bupleuroides, 8179 Richardsonii, 8187, 8192, 8193 gramineus, 8194, 8195 gramineus v. maximus, 9924, 10104 perfoliatus v. bupleuroides, 11160 natans, 11162 alpinus v. tenuifolius, 11165 perfoliatus v. bupleuroides approaching v. typicus, 11166 perhaps alpinus \times perfoliatus v. bupleuroides, 11169 perhaps gramineus \times perfoliatus v. bupleuroides, 11170 perfoliatus v. bupleuroides, 16052 natans, 16056 Richardsonii, 16057 gramineus, 16062, 16063 natans, 16064 gramineus v. maximus, 16065 amplifolius, 18460 alpinus v. tenuifolius, 18462 Richardsonii, 20451 gramineus, 20452 gramineus v. maximus, 20454 perfoliatus, 20456 perfoliatus v. bupleuroides, 20457, 21201, 25815 amplifolius, 27897 perfoliatus v. bupleuroides, 28603 gramineus, 28604 gramineus \times perfoliatus v. bupleuroides, 28605 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii).
- Victorin & Rolland.** 9922 Oakesianus, 9923 alpinus v. subellipticus, 9924 perfoliatus v. bupleuroides, 18575 alpinus v. subellipticus, 18576 gramineus, 20462, 20468 alpinus v. subellipticus, 25609, 25810 gramineus, 25938 alpinus v. subellipticus, 25939, 27094, 27095 gramineus v. maximus, 27630 alpinus v. tenuifolius, 29088 perfoliatus v. bupleuroides, 33178 Richardsonii (perhaps perfoliatus v. bupleuroides \times Richardsonii), 33180 gramineus v. maximus, 33879 perfoliatus v. bupleuroides, 43565 nodosus, 43576, 43796 perfoliatus v. bupleuroides, 44070 natans, 44738 gramineus \times perfoliatus v. bupleuroides, 45184 Richardsonii, 45189 crispus, 46699 nodosus, 49141 crispus, 49148 Richardsonii, 49304 nodosus, 49366 amplifolius.
- Victorin, Rolland, Brunel & Rousseau.** 17278 perfoliatus v. bupleuroides, 17285 gramineus approaching v. maximus, 17286 perfoliatus v. bupleuroides.
- Victorin, Rolland & Jacques.** 33315 alpinus v. subellipticus, 33316 natans, 33393 perfoliatus approaching v. bupleuroides, 33477 gramineus, 33517 amplifolius, 33518 praelongus, 33609 Richardsonii, 33639 Oakesianus, 33838 praelongus, 33854, 33856 natans, 33858 amplifolius, 33879 perfoliatus v. bupleuroides, 33714, 33855 gramineus, 44182 praelongus, 44451 alpinus v. subellipticus, 44452 gramineus, 44453 gramineus \times perfoliatus v. bupleuroides (probably backcrossed with gramineus), 44454, 44458 gramineus, 44459 gramineus \times perfoliatus v. bupleuroides, 44460 natans, 44463 gramineus v., 44465 gramineus, 44467 perfoliatus v. bupleuroides, 44468 alpinus v. subellipticus, 44749 Oakesianus.
- Victorin, Rolland & Louis-Marie.** 20467 alpinus v. subellipticus.
- Victorin, Rolland & Meilleur.** 43730 alpinus v. tenuifolius, 43858 nodosus, 44382 gramineus v. or gramineus \times sp., 44728 natans, 45446 Richardsonii.
- Victorin, Rolland, Michel & Meilleur.** 43633 Oakesianus.
- Waghorne, A. C.** 6 alpinus v. tenuifolius, 40 perfoliatus v. bupleuroides.
- Wahl, H. A.** 174 amplifolius, 204 perfoliatus, v. bupleuroides, 240 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides \times sp.).
- Walker, Mr. & Mrs. E. P.** 994 natans.
- Ware, R. A.** 2446 perfoliatus v. bupleuroides, 3324 natans, 3326 amplifolius.
- Warnock, B. H.** T557 nodosus.
- Watson, S.** 396 perhaps alpinus \times gramineus, 397 Richardsonii, 398 nodosus, 1131 natans, 1132 alpinus v. tenuifolius, 1133 nodosus (perhaps illinoensis \times nodosus), 1134 gramineus, 1135 Richardsonii.
- Watson, W. R.** 969 gramineus, 973

- gramineus approaching v. maximus, 979 natans, 1006 amplifolius, 1023 Richardsonii, 1178 amplifolius, 1253, 1418 gramineus, 3142 natans, 3144, 3145 alpinus v. subellipticus, 3158 gramineus, 3651 Richardsonii.
- Weatherby, C. A.** D2409 amplifolius, 3389 gramineus, 4364 natans.
- Weatherby & Anderson.** 5901 amplifolius, 5904 natans.
- Weatherby, C. A. & Una F.** 5625 gramineus approaching v. maximus, 6624 gramineus.
- Webb, R. J.** 452, 546 amplifolius.
- Webber, H. J.** 4 amplifolius, 5, 6 nodosus.
- Welch, Winona H.** 2106 nodosus.
- Werner, W. C.** 954 illinoensis.
- Wetmore, A.** 395 nodosus, 541 natans, 549 gramineus v. maximus, 550 gramineus.
- Wetmore, R. H.** 103096 gramineus v. maximus.
- Wetmore.** 2988 gramineus.
- Wheeler, C. F.** 7 natans, 10 praelongus, 11, 12 illinoensis, 13 amplifolius, 16 illinoensis, 19 Richardsonii, 21, 24 illinoensis, 26 alpinus v. tenuifolius, 27 gramineus, 89 Richardsonii, 90 alpinus v. tenuifolius, 231 illinoensis, 273 praelongus.
- Wheeler, L. C.** 1974 nodosus, 3973 natans.
- Whited, K.** 3141 Richardsonii.
- Whitford, H. N.** 251 gramineus, 254 natans, 258 alpinus v. tenuifolius.
- Whitney, Elsie G.** 4673a amplifolius.
- Wiegand, K. M.** 11178 illinoensis, 11182 crispus.
- Wiegand, Gilbert & Hotchkiss.** 27339 Oakesianus.
- Wiegand & Hotchkiss.** 27337 alpinus v. tenuifolius, 27343 gramineus \times perfoliatus v. bupleuroides (probably backcrossed with gramineus).
- Wiegand & Pease.** 27340 gramineus.
- Wight, W. F.** 1 praelongus, 8 illinoensis, 9 natans, 59 illinoensis, 61 gramineus, 76 illinoensis, 86, 87a, 87b, 87c, 88 nodosus, 97 amplifolius, 98 nodosus, 109 amplifolius, 123 nodosus, 152 natans.
- Wiggins, I. L.** 6757 natans, 6775 gramineus v. maximus, 6777 natans, 6796 gramineus, 6797 natans.
- Williams, R. S.** 285 nodosus, 804 Richardsonii, 900 gramineus.
- Williams, T. A.** 1 nodosus, 344 amplifolius.
- Williamson, C. S.** 418 Oakesianus, 455 polygonifolius, 472, 1026 perfoliatus v. bupleuroides.
- Williamson, Mrs. W. T.** 309 nodosus.
- Wilson, P.** 189 amplifolius.
- Wolf, J.** 760 alpinus v. tenuifolius, 961 gramineus.
- Wolff, Simon E.** 3290 nodosus.
- Wood, F. F.** 4 Richardsonii.
- Wright, C.** 675 nodosus, 676 illinoensis, 1893 nodosus.
- Young, J. P.** 542 illinoensis.
- Yuncker, T. G.** 361 amplifolius, 713 praelongus.
- Yuncker, T. G. & E. C.** 7011 Richardsonii.
- Zeller, S. M. & E. B.** 1237 gramineus, 1238 amplifolius.

CALTHA NATANS IN CANADA.—Lakela's¹ interesting account of the rediscovery of *Caltha natans* Pall. in Minnesota in 1942, recalls the collection of this species by W. N. Denike at Ingolf, Ontario, in July, 1940. I recorded this collection, which was the first Ontario record, in the Canadian Field-Naturalist, 55: 18 (1941) and at the same time presented an account of the known distribution in Canada and the United States. It should be

¹ Lakela, O., RHODORA, 45: 53-55 (1943).

noted that one Manitoba record exists, namely a collection by Lowe from a creek between High Lake and Falcon Bay, August, 1920.—HAROLD A. SENN, Division of Botany, Department of Agriculture, Ottawa, Canada.

POLYGONUM PURITANORUM IN MAINE.—On the wet sandy beach of Keoka Lake, at Waterford, Oxford County, Maine, on 8 July, 1941, I collected a small *Polygonum*, suggesting *P. Persicaria* L., yet different enough in aspect from that species to make me hesitate in determining its exact status. Professor Fernald has kindly identified it as *P. puritanorum* Fern., a coastal plain species published in RHODORA, xxi. 141 (1919) from Plymouth and Barnstable Counties, Massachusetts, to which Grand Lake, Annapolis Co., Nova Scotia, was later added. The broad strand of Keoka Lake—in 1941 perhaps more extensively uncovered than usual—matches well the habitats in which this plant has previously been collected, and supports as very abundant neighbors such plants as *Gratiola aurea* and *Utricularia cornuta*. This somewhat inland station is not out of keeping with the appearance of certain other coastal plain plants in the region of Ossipee and Madison, New Hampshire, and again emphasizes the need for more detailed study of this part of western Maine and east-central New Hampshire.—ARTHUR STANLEY PEASE, Cambridge, Massachusetts.

A DOUBLE-FLOWERED FORM OF *GILLENIA TRIFOLIATA*.—During a collecting trip on June 22, 1941, sponsored by the Department of Botany of the University of Pennsylvania to collect material for a new state flora, a multi-petaled form of *Gillenia trifoliata* was found. A single clump was growing on an open, sunny bank bordering a woods, $1\frac{1}{2}$ miles southeast of Wells Tannery, Fulton County, Pennsylvania. In each flower most of the stamens were replaced by petals so that at a short distance it resembled a miniature double-flowered chrysanthemum, often seen at flower shows. Each flower was decidedly pinkish in color, but in all other respects the plant was like the normal species.

Similar doubling occurs frequently in nature and in plants under cultivation. Hoping to introduce this form into the gardens, a small portion of the root was carefully removed, but the attempt at propagation was unsuccessful. It is hoped that this beautiful plant will remain in existence until such time as the world will be more interested in perpetuating rather than destroying natural beauty so that a second attempt can be made.

Careful checking by Dr. L. H. Bailey of the Bailey Hortorium and Dr. Lyman B. Smith of the Gray Herbarium indicates that this form is as yet undescribed. The name now proposed is

GILLENIA TRIFOLIATA (L.) Moench, forma **multipetala**, f. nov., floribus plenis; staminibus petalis permutatis; inflorescentia globosa supra complanata.

Flowers double by conversion of most stamens to petals; head globose, flattened on top. *J. W. Adams* 5054 (single specimen collected and deposited as the TYPE in the University of Pennsylvania Herbarium).—J. W. ADAMS, The Morris Arboretum of the University of Pennsylvania.

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